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ELECTRICITY ON THE MAIN LINE RAILWAY.

Notwithstanding the fact that their art is one which has produced the most revolutionary result that has attended the development of any other, save only one, railroad engineers are, as a body, extremely conservative people. They have, possibly for this reason, been slow in adopting the electric motor for their own use, and have waited to see the final outcome of the extraordinary evolution of the electric railway motor before using it as means for traction on their lines.

No one can doubt for a moment that this waiting has been wise, but it is perhaps possible to say now that longer waiting is needless; that the time is ripe for the replacement of the locomotive on certain lines of railway with the electric motor, to the vast betterment of the comfort of travel and the cheapness of operating lines.

The whole subject can fitly be expressed in an economic equation; the costs of installation and operation of an electric system must be measured against the profits that would accrue from its use, and this must be compared with the existing state of things. It is well-known that electric currents can be generated, transmitted and reconverted into mechanical energy delivered at the rim of the car wheel at a less cost for horse-power than it is possible to achieve by use of a locomotive carrying its own fuel and water and using them under wasteful conditions. But this difference is not large, nor is the cost of fuel a factor of controlling importance in the operation of railways. The difficulty that has generally met those who argue for the introduction of electric railways has been that of conceiving railway service conducted in other ways than those now in vogue. It can be demonstrated that on a crowded and much traveled section is the place of all others where the superiority of the electric motor will be shown, but it is probable, if the consideration of the relative merits of the two forms of motive power is confined to the operation of trains of several cars for passenger service, that no great advantage will be exhibited by the electric system. It is when the possibility of changing the whole method of operation of passenger service on railways is taken into consideration that the great value of the electric system is at once evident.

Consider, for example, the section of the Pennsylvania Railroad extending from New York to Philadelphia, a distance of about ninety miles. With alternating-current distribution this section could be worked with economy and success from two power stations, possibly from one. At present it is traversed during most of the daytime by fast express trains running at a headway of from one to two hours, and of which there are almost all the time several in motion on the section. In addition to these there is a considerable number of local trains, running at slower speeds and stopping at all stations, in more or less constant service. If the section were electrically equipped, instead of running a six-car express train every sixty minutes, nothing would be easier than to to run a one-car express train every ten minutes, and in the rush hours instead of putting out five-car local trains every ten minutes, one-car local trains could be sent out every two minutes. It is impossible to give any figures as to the increase in travel that would result from this important betterment of travel conditions, but it is perfectly certain that such a system, closely analogous to the street-car service which has grown to such enormous proportions since street cars were electrically operated, could not fail to increase travel and to pay. Furthermore and finally, there is nothing whatever of an experimental character about it. It is known in advance, not only that such a system would work and work well, but almost exactly what its cost of operation will be.

REGISTERING ELECTRICIANS.

A bill has been introduced in the legislature of the state of New York, providing for the registration and licensing of electrical workmen somewhat after the plan now adopted for licensing steam engine men, pilots, and others whose occupations are such that much property and often many lives depend upon their skill and a knowledge of their business. The reason that this idea has been advanced is that whenever a fire occurs of which the cause is not immediately evident it is at once charged to "electric wires." Now, it is undoubtedly possible that some fires have been caused by defective workmanship or bad installation of electric apparatus, and any measure which adds to the safety of electrical installations should certainly be welcomed by the profession at large. Still, the outcry concerning the danger of electrical installations is largely based on imaginary causes and does not itself constitute a sufficient reason for any change in the existing order of things. So far as the licensing of electricians is concerned and their due examination for competence, there is no reason why it should not be done, nor why it would not be productive of good results. No workman worthy of his trade should hesitate to apply for examination for license and to have his capacity and capability duly attested by the licensing board. It seems that under proper conditions of examination the suggested move would be a good one. The ELECTRICAL REVIEW would like expressions of opinion on the subject from the members of the profession and especially from electrical workmen and contractors who would be more directly interested in the practical workings of such a law.

AN EXCEPTIONAL VALENTINE.

Mr. H. H. Vreeland, president of the Metropolitan Street Railway Company, of New York city, received last Wednesday, which was St. Valentine's Day, probably the most valuable valentine present ever sent. It was a check for $100,000 from the group of capitalists who control the Metropolitan system. The occasion is not only one which calls for congratulations to Mr. Vreeland, but as well to his company for their appreciation of his valuable services. Men of the type of President Vreeland are almost certain of recognition, and corporations are looking for such men everywhere and willing to pay their price. His management of the properties of the Metropolitan Company has been such as to direct toward him the enthusiastic admiration of all his business associates, and as one of them truly said in a recent interview, his handling of the recent strike situation saved the company many times the amount of the gift of $100,000. The fact that a street railway corporation can make such a present is not only a commentary upon the silliness of the claim that corporations have no souls, but an astonishing illustration of the growth and importance of an industry that is less than fourteen years old.

HOW TO GET FOREIGN BUSINESS.

The average American manufacturer who has organized his business staff along the lines which experience has shown to be best for the extension of his trade in this country is met at the outset of his efforts to obtain foreign business by differences in the method of conducting affairs on the two sides of the Atlantic. He finds, for example, that he must change his catalogues, his price-lists, his terms of payment and his method of soliciting trade in order to compete successfully in the foreign markets. It is not the object of this paragraph to give any instructions to manufacturers on these all important subjects, but solely to direct attention again to the vital importance of addressing the prospective customer in terms with which he is familiar.

In most of the continental countries of Europe the metric system of measurements prevails and is the only one generally understood by the people. In each of these countries a different monetary system prevails and the unit is different from our dollar. Consequently, price-lists and dimensions must be given in each country, not only in the language of the people to whom they are addressed, but also in these units of measurement, both financial and material. This may seem to be a small matter, but it is one of the small matters that makes the vital difference between success and failure. When a price-list is received here from a French manufacturer giving dimensions in the metric measure and the prices in francs, it is necessary to translate it before it is intelligible to the man of average business education. Even if he be well acquainted with the language he can not think in strange units of measure. It is just this difficulty that should be avoided in the preparation of catalogue matter for foreign circulation, and this is only one of the many points that the American seeking for export business must bear in mind.

THROWING AWAY DOLLARS.

At the recent meeting of the Northwestern Electrical Association much of the discussion turned upon the sale of the sole by-product of an electric lighting or power station—steam. In about nine out of ten small electric railway or light plants the exhaust steam is simply thrown away and becomes, on account of its noise, a nuisance, while it carries away into the atmosphere thousands upon thousands of heat units which could be made available if properly applied. It is too late to undertake the installation of steam heating plants in connection with electric light station for this Winter, but it is an excellent time to prepare for their installation next Winter. There is no subject that is better worth the careful and studious attention of station managers than this of selling exhaust steam for heating purposes. Every cent that they can take in by this operation is clear gain.

ENTERPRISE IN MEXICO.

It is well for American manufacturers of electrical supplies to keep their eyes on Mexico. That republic, under the admirable administration which has characterized its affairs in recent years, is growing in wealth and seeking constantly to better its conditions of transportation and in general to enjoy the more modern products of industry.

There are now under consideration a large number of schemes for the erection of new electrical works in Mexico. The street railways at Monterey, Morelia, San Luis Potosi, and in the City of Mexico are either extending their electric systems or are in process of change from horse to electric traction. A large quantity of mining machinery is needed in the silver districts and abundant opportunity offers for long-distance transmission lines and for the general exploitation of electrical industries throughout the country.

Crossing the Connecticut River with Overhead Wires.

In long-distance telephone work it is necessary to avoid, as far as possible, the use of submarine cable for the reason that the cable itself and its necessary protective devices both impair the efficiency of circuits for telephonic purposes by reason of their induction and capacity. In the new through lines from Boston to the West and South recently erected by the American Telephone and Telegraph Company, the crossing of the Connecticut River, at a point five miles north of Middletown, Ct., necessitated the use of some method other than cable, and for the purpose, aerial spans of wire 1,300 feet long were used, the wire being suspended from a high steel tower on either bank of the river. The illustrations show the two fixtures erected at this crossing.

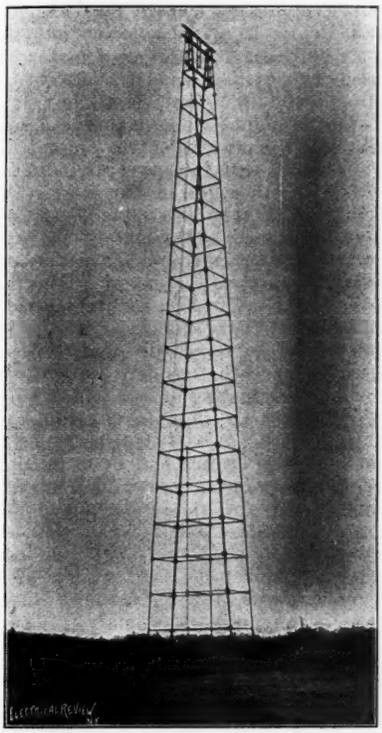


FIG. 1.—TOWER AT EAST SIDE OF CONNECTICUT RIVER.

Fig. 1 shows the tower on the eastern side. This stands in an extensive meadow, and reaches a height of 182 feet. Fig. 2 shows the tower on the other bank, which is a high bluff, so that the height of the tower is only 82 feet. The towers are 1,300 feet apart. The fixtures on the tops of the towers consist of saddle-shaped insulators of cast-iron, lined with wood and insulated by micanite strain insulators. The fixtures now carry 20 wires, though their capacity is 40. On account of the long span and the natural swinging of the wires in windy weather it was necessary to string all of them at equal tension to avoid crosses. To accomplish this a tension device is introduced into each wire. This consists of an iron bolt five-eighths inch in diameter, by 20 inches long, provided with a strain insulator at one end and a nut at the other. The wire used is of the variety known as " phono electric," consisting of a copper alloy, and is 0.165 inch in diameter and has a tensile strength of 82,000 pounds per square inch. At some distance back from each tower are double poles on which these wires are dead ended. The towers are built of structural steel to bridge builders' specifications, the structure being perhaps most clearly shown in Fig. 2. The diagonals for the wind strain bracing are all provided with turn-buckles and a ladder at each tower permits repair men to ascend it with facility.

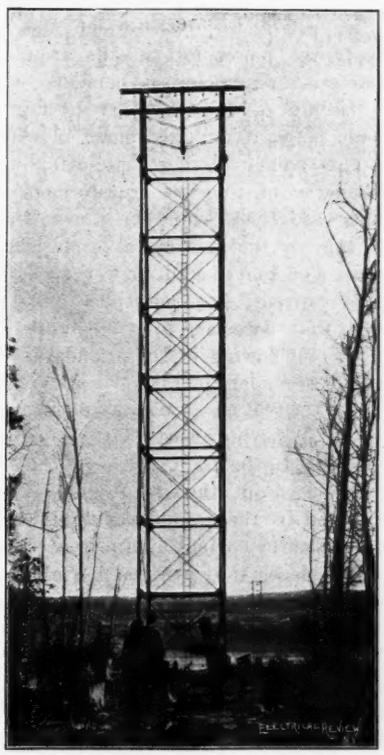


FIG. 2.—TOWER ON WEST SIDE OF RIVER.

Electric Auxiliary Locomotives.

A press despatch from Cumberland, Md., says that the Baltimore & Ohio Railroad will enlarge the power house at that place for the purpose of running all westbound trains up the Allegheny Mountains on what is known as the seventeen-mile grade by electricity. The road has no engines with pulling capacity sufficient to pull the heavily loaded freight trains up the steep grade without assistance.

Registration of Electricians.

A bill has been introduced in the New York Legislature by Mr. Henry, requiring the registration of electricians. The introducer says the bill is in the nature of a protection against fire, as it is to prevent incompetent persons from tampering with electric light wires in buildings where electricity is used. The electricians who wire the buildings are now held responsible for their work, and they claim that after they have finished it in many instances inexperienced persons are called in to do odd jobs and leave the wires in such shape that there is danger from fire. The bill would not permit any but registered electricians from touching the wires.

New York Edison Company.

The stockholders of the Edison Electric Illuminating Company, of New York, controlled by the New York Gas and Electric Light, Heat and Power Company, which is owned by the Consolidated Gas Company, met on February 13. The following were elected directors for one year: Hugh J. Grant, A. F. Brady, Thomas E. Murray, Louis B. Gawtry, R. A. Carter, Alfred B. Thatcher, William H. Bailey, Henry J. Hemmens, John W. Lieb, Jr., Jas. S. Connell, Henry Morgenthau, Frank Enos and Michael F. Phelan.

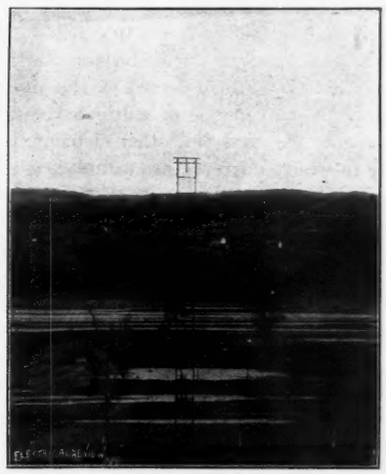


FIG. 3.—LOOKING ACROSS THE RIVER FROM THE EAST SIDE.

Suit For Injunction Dismissed.

The suit brought some time ago by the Colliery Engineer Company, of Scranton, Pa., conducting the International Correspondence Schools, against the American School of Correspondence, of Boston, Mass., was recently dismissed by Judge Lacombe of the United States Circuit Court.

The German-American Cable.

The German direct cable from Emden to New York, by way of the Azores, will be laid by a London company. It will be 4,336 miles long and will cost £985,000.

THE POLYPHASE INDUCTION MOTOR.*

BY RALPH D. MERSHON.

(*Concluded from page 158.*)

The statement was made above that the terms "armature" and "field" as applied to the two elements of the induction motor were incorrect. Consider what these two terms signify. The armature of a direct-current motor is that element of the motor in which an electro-motive force is generated; the field of the direct-current motor is that element in which no electro-motive force is generated. This criterion when applied to the induction motor shows that neither element is either armature or field, for both have electro-motive forces generated in them. In Fig. 7 the stationary element, when fed with alternating currents, has a counter electro-motive force generated in it just as does an alternating-current transformer, and as we have seen in the discussion of Fig. 7, the rotating element also has generated in it an electro-motive force to which is due the currents in the short-circuited winding. Neither will it do to call the rotating element armature, and stationary element field, for just as the armature of a direct-current machine may be stationary and the field rotate, so we may interchange the functions of the rotating and stationary elements of the induction motor.

By far the best course is to consider the induction motor as a transformer. In this case the element connected to the line is the primary (rotating or stationary as the case may be), and the other element, the one in which currents are induced, is the secondary (stationary or rotating). What has been heretofore designated as the field in Figs. 3, 4, 5 and 7, is now the stationary primary; the rotating element is the rotating secondary. Let us look into the question of the induction motor as a transformer. In Fig. 7, first consider the rotating secondary A (formerly the armature), as held so that it can not rotate. The rotating magnetic field will induce alternating currents in a short-circuited winding. Now some of these closed circuits are directly opposite the poles, A_1, A_2, and will affect these poles and the windings upon them, just as the currents induced in the secondary of a single-phase transformer influences the primary of the transformer. Similarly some of the closed circuits are directly opposite the poles B_1, B_2, and bear toward them, the relation of secondaries. Some of the closed circuits are influenced by and exert influence on both sets of poles and have on each set of poles only part of the effect that they would have if opposite one or the other of the two sets. The result, however, so far as the electrical actions and reactions between the primary and secondary of the motor are concerned, is the same as though we considered the two pairs of poles A_1 and A_2 and B_1 and B_2 as being single-phase transformers, each having an equivalent short-circuited secondary whose action on its primary is the same as that of the closed circuits of Fig. 7 on the pairs of poles A_1, A_2 and B_1, B_2. If all the circuits of the short-circuited secondary of Fig. 7 should be open-circuited so that no current could flow in them, it would be equivalent to opening the secondary circuits of the two transformers. The current which would then flow in each of the primaries of the transformers would be simply the current necessary to magnetize the transformer and to supply the power lost in the iron by hysteresis and eddy currents. If the circuits of the secondary of Fig. 7 should be short circuited again it would be equivalent to short-circuiting the secondaries of the two transformers, in which case there would be drawn from the line by the primary of each transformer a current in addition to the magnetizing current, the additional current being that necessary to compensate for the current flowing in the secondary. If now the secondary of Fig. 7 be allowed to rotate, the electrical conditions change from those having place when the motor is at rest. In the first place, as has already been pointed out, the electro-motive force generated in the secondary, diminishes, hence also the current diminishes; in the second place, the currents flowing into secondary generate, by virtue of the rotation of the conductors in which they flow, an electro-motive force in the primary. This electro-motive force, generated in the primary, corresponds to the counter electro-motive force of a direct-current motor, and it is against it that the primary current does the mechanical work of the motor. Comparing again the motor of Fig. 7 to two single-phase transformers, the conditions when the motor is allowed to rotate are as though we had included in the secondary circuit of each transformer a laminated motor, series wound as for direct current, but run of course by the alternating current from the transformer. When the two series-wound motors are held so they can not rotate, and the secondary circuits of the transformers are closed through them, we have a condition similar to that when current is thrown on the primary of Fig. 7, the secondary circuits being closed, but the secondary held so that it can not rotate. When the two series motors are allowed to rotate, we have a condition similar to that when the secondary of Fig. 7 is allowed to revolve; that is, the currents in the secondaries of the two transformers are diminished and a counter electro-motive force is introduced through which mechanical work is done. The slip, or fall in speed, of the induction motor corresponds to the drop, or fall in voltage, of a static transformer.

So far we have treated the induction motor only as a constant-speed motor, one which carries its load at constant, or approximately constant speed, but it is possible to adapt it to variable speed work also. In the practice of the present day it is usual to vary the speed of induction motors in either one of two ways. One of these is to vary the voltage impressed upon the primary of the motor; the other is to introduce resistance into the secondary circuits of the motor. The first method is used in the case of a motor having a stationary primary and a rotating secondary of the so-called "squirrel cage" type, similar to that crudely illustrated in Fig. 7 and consisting of bars laid in longitudinal holes or slots in a cylinder of laminated iron, the bars being permanently short-circuited at each end by metal rings having a resistance whose value is properly proportioned for the work which the motor is to do. Such a motor has, of course, no sliding contacts, and the construction of its secondary is such as to enable it to withstand a great deal of hard usage. The impressed primary voltage is varied by means of transformers, the voltage being raised or lowered until the proper speed has been attained by the motor. The second method is used in connection with a motor having slip rings on the rotating element. As previously mentioned the rotating element may be either primary or secondary. In the former case the slip rings serve to connect the primary windings with the line. In the latter case the slip rings furnish a means of introducing resistances into the secondary circuits. This resistance is in the form of a suitable rheostat, so that the amount of resistance included in the secondary circuits may be varied. The theory of the speed variation attained by either of the methods outlined will be clear on considering what has been previously discussed. Take the case of speed variation by varying the impressed primary electro-motive force. Suppose the motor of Fig. 7 were carrying, at a given voltage, and at some speed less than its no-load speed, a load of constant torque. Suppose now the voltage impressed upon the motor be increased. We know that in a transformer an increase of voltage means an increase of magnetization in the transformer core. This will be the case in the motor also. By increasing the primary voltage the strength of the rotating magnetic field will be increased. But a strengthening of the rotating field will cause an increase in the electro-motive force generated in the secondary and consequently an increase of the current in the closed circuits of the secondary. Now, the increased secondary currents mean an increased torque, so that, since the torque of a load is constant, the

*Abstract of a paper read before the Northwestern Electrical Association.

motor will speed up, thus diminishing its slip and, consequently, the strength of the currents in the secondary. The slip will continue to diminish, that is, the speed will continue to increase until the secondary currents fall back to the values which they had before the primary electro-motive force was changed. That is, they will fall back to a value just sufficient to produce the torque necessary for carrying the load. If on the contrary, the primary electro-motive force instead of being increased were to be diminished, the speed of the motor would fall. For a given load there will be a speed corresponding to each voltage impressed upon the motor, the speed increasing or diminishing when the voltage increases or diminishes, but no matter how high the voltage be raised, the speed can never quite equal that of the rotating field, although as has been previously explained, it may approach it very nearly. The speed of the rotating field is the limiting speed of the motor to which the motor speed may be made to approach closely either by greatly increasing the motor voltage with a given load or by making the load upon the motor very light.

When resistance is introduced into the secondary of a motor carrying a load of constant torque, the speed diminishes because the introduction of the resistance decreases the secondary current. The speed will fall until the slip, and therefore the secondary electro-motive force increases to such a point that the value of the secondary currents is the same as before the resistance was cut in. With a given load, the greater the resistance the less the speed, and the less the resistance the greater the speed up to the no-load speed of the motor.

The methods described for controlling variable speed induction motors is also used in starting constant-speed motors. Such a method of starting not only avoids an excessive torque at the instant of starting, but keeps down the starting current, accomplishing the same result as is attained by the use of a starting rheostat in the armature circuit of a direct-current shunt motor. Indeed, the behavior of an induction motor whose speed is varied by means of a rheostat in the secondary is identical with that of a direct-current motor whose field is kept constant and whose speed is varied by means of a rheostat in the armature circuit, while the behavior of an induction motor whose speed is controlled by a variation of voltage is identical with that of a shunt-wound direct-current motor when the voltage delivered to both armature and field is varied at the generator. This latter statement should not be confused with the condition which has place when the field of a direct-current motor is kept constant and the voltage impressed on its armature is varied at the generator.

The type of polyphase induction motor most generally used to-day is not of the design depicted in Fig. 7. The primary has no salient poles like those of Fig. 7. Both primary and secondary have slotted cores of laminated iron. The primary winding consists of overlapping coils laid in the slots and forming a "distributed winding," similar to that of a direct-current armature. The primary still has poles just as truly as Fig. 7 has them, and the number of these poles in each circuit determines the speed of the rotating field as previously explained in connection with Fig. 3, but the poles are due to the grouping of the primary coils and not to a polar projection as in Fig. 7. Also the coils forming the windings of the two circuits in case of a two-phase motor or of the three circuits in the case of a three-phase motor overlap, but the winding of each circuit is arranged with reference to the poles of that circuit. All the circuits of the primary are, of course, wound so as to have the same number of poles. The secondary winding depends upon the type of motor; whether it is one having no slip rings and started by supplying it with a reduced voltage, or whether it has slip rings and is started by introducing resistance in its secondary. In the latter case the secondary winding is very similar to that of the primary; in the former case, the squirrel-cage winding is used. Fig. 8 shows the two elements of a motor having a stationary primary and a rotating squirrel cage secondary. This figure shows the slotted cores of the primary and secondary, the over-lapping coils of the primary and the bar-wound short-circuited secondary.

The current taken by an induction motor is comparable to that of a transformer having a comparatively large magnetizing current, for the induction motor is a transformer with an air-gap in its magnetic circuit. At no-load the motor taken current sufficient to magnetize the iron and air-gap and this no-load current bears a greater proportion to the full-load current than in the case of most static transformers, because of the fact that the static transformer generally has a closed magnetic circuit. The no-load current taken by the motor is not, however, all of it, work current. That is to say, the product of the no-load current by the voltage at which it is delivered does not represent the power supplied to the motor. In a good motor only a small per cent of this product or "apparent power" is true power, and this small percentage of the "apparent power" represents the no-load loss to the motor. The percentage which the true power supplied to the motor at a given load is of the apparent power supplied, that is, the ratio of the true power to the apparent power, is called the "power factor." The value of the power factor is different for each load put upon the motor, for as the motor is loaded the current supplied to it increases, but the increase is not in proportion to the load. The increase of the current is less rapid than the increase of load, and, in consequence, as the load upon the motor increases the apparent power supplied to it becomes more and more nearly equal to that of the true power, that is, the power factor of the motor increases. This increase of power factor continues until it reaches a maximum, generally at a point somewhere near the rated full-load capacity of the motor.

Although throughout this paper a two-phase induction motor has been considered, the conclusions arrived at apply equally well to a three-phase motor, as the principles involved in two-phase and three-phase motors are identical. The two-phase motor was chosen as being simpler of explanation.

The advantages of the polyphase induction motor are easily apparent to any one who has handled this class of machinery. Its development has made possible a motor self-starting under load and without moving contacts. This means a motor free from commutator troubles which in turn means a motor which will stand an amount of overloading and rough usage that would soon put a direct-current motor out of service. It means a motor which can be installed under conditions where no other type of motor could survive, and which will require an amount of attention as small as is possible in a piece of moving apparatus. It is the nearest approach in a piece of moving apparatus to that nearly perfect electrical device, the static transformer. Its crowning advantage is that with all the advantages mentioned it is an alternating-current motor; a motor which, in connection with static transformers, can be adapted to any voltage, thus making possible the safe and successful distribution of light and power from one system at a high voltage.

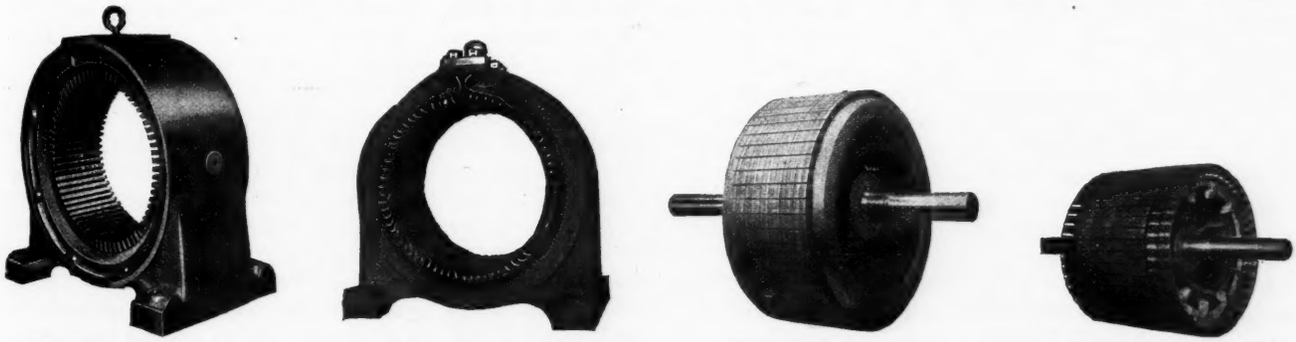


FIG. 8.—PRIMARY CORE: PRIMARY WOUND: SECONDARY CORE · SECONDARY COMPLETE.

Magnalium—Its Properties and Uses.*

Magnesium, it is well-known, is a grayish white, soft metal of a certain toughness, which, physically, resembles aluminum. Its specific gravity is even smaller. Although it can be formed into wires and ribbons and rolled into sheets, it can not readily be filed, turned, or cut. Chemically, however, it is not so resistant as aluminum. Polished surfaces of aluminum lose little or nothing in brightness when exposed to the air; but magnesium under similar conditions is soon covered with a skin of oxide. Dr. Ludwig Mach discovered that alloys of magnesium and aluminum possess properties not found in either of the two components. Woehler also made alloys of magnesium and aluminum by fusing together equivalent weights (in the proportion therefore 27.5:12) of the two metals and obtained a white, extremely brittle mass which ignited at red heat and burnt with a bright flame. By mixing four equivalent parts of magnesium with one equivalent of aluminum, a semi-malleable mass was obtained, which, owing probably to the presence of sodium chloride, decomposed in water after a few days without generating hydrogen. Later investigators, Parkinson, for example, have come to the conclusion that alloys of aluminum and magnesium have no practical value. Even Richards, in his work on aluminum published as late as 1890, forms the same conclusion.

The unsatisfactory results obtained by these physicists, according to Mach, are due to the use of impure metals, and to the lack of a systematic variation of the proportions employed. If pieces of magnesium be dissolved in molten aluminum by dipping them in the superheated mass with a porcelain rod, alloys will be obtained which differ widely in their mechanical properties, depending upon the quantity of magnesium originally employed. Alloys which for 100 parts of aluminum contain 10 to 30 parts by weight of magnesium are as a general rule ductile, vary in hardness between brass and bronze, and can be most readily worked with a file, on the lathe or rotary cutter. The specific gravity of these alloys varies between 2 and 2.5; whereas pure aluminum has a specific gravity of 2.7. Alloys thus obtained can be cast in thin liquids as readily as aluminum, and fill the mold fully as well; on the lathe they can be turned like brass into long, coiled strips. The surface becomes mirror-like in brightness and silvery in appearance. Screws can be cut cleanly to any pitch. Under the file the characteristic ring of brass or steel is heard. Even the teeth of the finest files are not clogged, at least not with those alloys containing from 25 to 30 per cent of magnesium and equaling bronze in hardness. Alloys containing from 10 to 15 per cent of magnesium can be turned, cut, rolled into sheets, and pulled into tubes and wire—all of which properties are possessed by aluminum. These alloys are furthermore capable of receiving a high polish; and the polished surfaces are distinguished by great resistance to atmospheric influence. They are whiter than aluminum or magnesium and are good light reflectors. For ordinary uses, where small weight, great tenacity, and strength are required, these alloys containing small percentages of magnesium are evidently extremely serviceable. Alloys in which the proportions are reversed, that is, those which contain little aluminum and much magnesium, have similar properties and smaller specific gravity, but are less beautiful in color. They are capable of resisting atmospheric influences and are of feeble strength. On exposure to the air they become spotted, and are corrosively acted upon by water and readily ignited in casting. When the oxide is not thoroughly removed and the mold is badly filled, the castings are not homogeneous.

At present the cost of these alloys is considerably greater than that of pure aluminum, owing to the higher price of magnesium. But the question of cost can not long affect the application of the alloy; for the new metal, measured by volume, is cheaper than brass. Moreover, magnesium is so expensive chiefly because it has been used only in small quantities and produced only on a small scale. When the metal will be more widely employed in the arts, it will probably become cheaper than aluminum; for it is manufactured from very inexpensive raw material and its reduction is attended with less difficulty than that of aluminum. We may, therefore, hope that Mach's alloy—"magnalium," as it has been called—will become one of the cheapest metals which we can use. The strength of the compound is extraordinary. Tests made by the inventor show that magnalium is stronger than cast-iron and less brittle. On cross-section it is fine grained, steel-like and splits in several directions. The coarsely crystalline structure of pure aluminum or zinc is not present. Stampings of magnalium are produced with the same readiness as those of rolled brass. The alloys of aluminum and magnesium described contain from 10 to 30 per cent of magnesium. With an increase of magnesium there follows an additional hardness, brittleness and capability of receiving a high polish. Mach's investigations were made primarily for the purpose of discovering a metal particularly adapted for mirrors, great hardness being the prime requisite in order to obtain the desired reflecting surface.

The art of making metallic mirrors is by no means new. The ancients, it is well-known, used them. In modern times amalgamated or silvered sheets of glass have been used for the ordinary purposes of life; for optical uses metallic mirrors have been employed. Up to the middle of the last century the achromatization of lenses was held to be an impossibility; and reflecting telescopes were therefore used in astronomy. Instead of the object glass now employed, these telescopes had a mirror of cast metal, ground in parabolic form. But the speculum metals hitherto used, although capable of being highly polished, have a specific gravity rarely below eight; their reflective power, moreover, is by no means equal to that of silver.

These defects, coupled with inability to withstand usage or exposure to the atmosphere, have rendered a new speculum compound almost a necessity. Magnalium offers all the advantages which have hitherto been lacking in ordinary speculum metals. For, when it is composed of equal parts of aluminum and magnesium, it is exceptionally hard, capable of receiving an exceedingly high polish, and, above all, of extraordinarily small specific gravity. The mechanical properties of alloys containing one part of aluminum and magnesium in proportions varying from two to one for the aluminum, and for 1 to 3.25 for magnesium, differ widely. The reflecting power of the alloy, especially when a minimum of aluminum is used, is fully equal to that of the best silver mirrors. The optical experiments made with magnalium mirrors by Dr. Victor Schumann, of Leipsic, lead to the conclusion that ultra-violet rays of the spectrum are better reflected by magnalium than by silvered glass; the same result holds good for the visible portion when certain alloys are employed.

Magnalium mirrors have preserved their reflecting power despite the chemical influence of the atmosphere. In this respect they are far superior to silver mirrors, which soon form sulphur compounds, and to steel mirrors, which oxidize so readily. The treatises which Mach and Schumann have written on this new metal fully describe its remarkable optical properties; of particular interest are those portions treating of the absorption of gases by the molten alloy, and the precautionary measures which Mach recommends to prevent this absorption.

*Translated from *Prometheus* by the *Scientific American*.

ELECTROSTATIC ROTATION—V.

BY ALFRED G. DELL.

In an article on the above subject published in the ELECTRICAL REVIEW of January 17, 1900, I stated that when sparks were passing under the mica disk therein described, the disk would sometimes rotate in either direction. In the following I will describe the results I have since obtained with the disk, and also state what I consider the cause of such peculiar rotations.

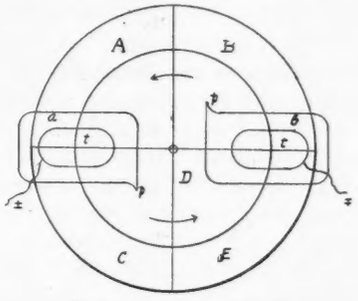
Referring first to articles published by others in regard to the spark discharges from the secondary of an induction coil: In the ELECTRICAL REVIEW, September 27, 1899, there appeared a note on the "Genesis of the Electric Spark" wherein B. Walter states that the electric spark "does not find its way across the dielectric all at once, but feels its way, so to speak, by several brush discharges proceeding from both electrodes, and eventually joining hands."

Overbeck measured the sparks between a point and plate attached each to a terminal of the secondary of an induction coil; he found the spark lengths, starting when they were nearly equal to one centimetre in length each, increased more rapidly when the positive was the point than when the negative was the point, with equal voltages.

On the above two experiments and my own I have built up a theory for the rotating disk.

I will first describe some additional experiments. I found that when I used a disk that did not rotate very freely, I could not obtain any rotation except in the direction from positive to negative; when I increased its sensitiveness of rotation, that I could obtain rotations both ways with what was a three-quarter-inch spark between points; but no rotation from the negative to positive with a one and one-half-inch spark, unless I reduced the distance between the points to about what was used for the three-quarter-inch spark.

When I further increased the freedom of rotation of the disk by using jeweled bearings, I could obtain a rotation in either direction with the one and one-half inch spark with the points further apart, but when rotated from negative to positive, I had to start it more rapidly than when I used the three-quarter-inch spark, and found it was more liable to reverse the rotations if the spark length between the points was separated to full length, but would run some time before doing so, if given a rapid start. The rotation from negative to positive was never as rapid as the rotation in the reverse direction. My theory is as follows: Suppose the disk is started from negative to positive, the charges on the disk opposite the discharge points are slightly shifted, the negative towards the positive point, and the charges opposite the positive point slightly back of that point. Now with charges being the same as their sources, there will be a repulsion between the charges on the disk, and the discharges from the points, and an increased attraction between the negative charges on the disk and the positive discharges, but a reduced attraction between the positive charges on the disk and the negative discharges, those charges having partly passes back of the positive point; so the resultant of the forces could act from negative to positive and drive the disk in that direction. I also stated



ELECTROSTATIC ROTATOR.

that sometimes the disk started itself from negative to positive. I found that this effect was caused by some minute obstruction at the end of the axle of the disk, making it turn in the position at which it stopped more readily from negative to positive. With the jeweled bearings it has never as yet started except from positive to negative, and when run in the opposite direction has to be started in that direction; its velocity depending upon the spark-length used.

When the points are shortened, making the spark-length used shorter, the velocity is diminished until the motion will finally stop, and there will be no rotations with the disk thus arranged, and with that length of spark. It will rotate from negative to positive with less starting velocity when the points are at their minimum distance apart, than when at their maximum distance.

It will be seen from the above that as the spark length is increased if the disk is not sensitive enough, there will be a rotation only from positive to negative, but by increasing its sensitiveness, a rotation from negative to positive can probably be obtained; but there is a limit to the spark length, beyond which, according to my experiments, there would be no rotation excepting a rapid one from positive to negative. Reversing the current of the primary of the coil has no effect excepting slightly to increase or diminish the velocity of rotation after running a little while, which is an evident consequence from the above, as the charges and discharges are quickly changed in character on reversal; and the disk being in rotation, they are too short to affect it during change.

It may be of interest to some to know how the disk is arranged. It is of mica, two and one-quarter inches in diameter, I gave it a coat of shellac, put on with a brush drawn radially so the shellac is in light ridges, although I doubt whether there is any effect from the ridges. As an axle I used a steel darning needle. I broke off its point and used that end as the top, it being tapering at that end. I then made it about one inch long, filing the other end to a sharp point to rest in the jewel at the bottom. The top, being tapering, throws the centre of gravity lower down. The disk I fastened on with sealing wax about one-eighth of an inch from the bottom. The needle, of course, passes through a hole in the centre of the disk. The jewels are fastened in brass screws; their holes are about one-sixteenth inch diameter and about the same depth. The screws containing the jewels are fastened into pieces of wood, the lower one in the centre of the cardboard on which rests the plates, arranged so I can raise or lower the upper piece. The cardboard on which rests the plates having the points has been fully described in former articles. The narrow plate that has to be moved around to adjust the spark length is not under the disk, but passes around on the outside, to avoid anything that might come from it to interfere with the experiments. The points are under the disk.

With the absorption of the People's Telephone Company, of New Orleans, which was an independent organization in that city, the announcement was made by the Bell Telephone Company that it will immediately begin the equipment of a long-distance system in that city, so that in a short time users of the long-distance 'phone in New York will be able to "hello" to their friends in New Orleans. The American Bell Company controls the Cumberland Telephone Company, which is the general system in the South. Heretofore the Cumberland system did not give the patrons of the New Orleans any connections with the neighboring towns outside of a few suburban cities.

SCIENCE BREVITIES

An Electric Mining Cartridge — The well-known Italian inventor, Dr. D. Tommasi, has devised an ingenious cartridge for mining and blasting purposes which is entirely inexplosive and safe until its contents are electrolyzed by the passage of a current through them. The cartridge is a stout glass tube, containing a platinum wire sealed in at each end, and is filled with a concentrated solution of ammonium chloride. When this perfectly inert substance is electrolyzed by the passage of a current through it, it decomposes into chlorine, ammonia and hydrogen. The chlorine reacts upon the ammonia and decomposes it with the formation of hydrochloric acid and chloride of nitrogen. When the gases disengaged attain a sufficient pressure the tube bursts and the shock resulting from this action detonates the chloride of nitrogen, which, as is well-known, is one of the most violent of explosive substances. The system seems entirely feasible and perfectly safe in practice.

Lightning and Fences—In the course of an interesting paper on lightning and its effect on trees, Mr. F. J. Brodie remarks in the *Journal* of the Royal Agricultural Society that in America much damage to live stock by lightning is believed to have arisen from the increasing adoption of wire fences. The director of the Iowa Weather and Crop Service, in his report on the thunderstorms of 1898, says: "Unquestionably wire fences, as now constructed, serve as death-traps to live stock, causing a vast amount of loss every year. And it is also quite evident that a considerable percentage of danger may be avoided by the use of ground wires at frequent intervals in the construction of wire fences." The point appears to be a practical one, deserving the notice not only of American but of English farmers, says *Nature,* the means of protection from a real source of danger being after all very simple.

Frequency Indicator — A simple and serviceable frequency indicator, devoid of any mechanism, can not but be a useful adjunct to the equipment of a central station. What claims to be such has been designed by E. Stockhardt. It is described in a German contemporary, the description being thus abstracted by Mr. E. E. Fournier d'Albe: It consists essentially of a tuning fork vibrating in unison with the current under investigation. The fork is tuned to the current by means of two weights, which are displaced along the prongs and pressed against them by metallic springs. The displacement is read off on an empirical scale giving the frequency direct. The range of the instrument is increased by the fact that it will resound to certain multiples of the frequency by means of its overtones. This advantage is, however, attended by the drawback that the value indicated is not necessarily of the correct order. It is therefore necessary to know the approximate frequency, say within 50 per cent. The definition is clear enough, and the tests show that an accuracy of considerably less than one per cent can be relied upon. Nor does the form of the current curve seem to interfere, for the instrument resounded equally well to the Dresden city mains, to an old Siemens alternator and a small Siemens rotary current generator. The manipulation of the instrument is ideally simple.

Magnetism and the Becquerel Rays— The mysterious Becquerel rays, which are radiated by a number of substances and are an apparent contradiction of the law of the conservation of energy, are at present subjects of earnest research by many physicists. The following abstracts of recent papers are due to Mr. E. E. Fournier d'Albe:

Herr F. Giesel may be said to have anticipated one of Becquerel's recent discoveries. He was able to produce several negatives showing very strikingly the deflection of Becquerel rays in a magnetic field. He took flat pole-pieces and laid a sensitive plate upon them film downwards. He placed a fresh and very active polonium preparation below the film and in contact with it. On development the blackening was found to be concentrated just in contact with the substance and along a zone on one side of the line joining the poles. The exposure was about five minutes. Between the black patch and the black zone there was a number of dark traces resembling wavy hair attached to the central patch as a head and extending into the dark zone. These traces are very difficult to account for. They somewhat resemble the ramifications seen in some Lichtenberg figures. The same effects are obtained with radium preparations, though not in the same strength as in the case of polonium. The magnetic deflection of Becquerel rays must now be considered as proved. Elster and Geitel's negative result was obtained with a vacuum, and not in the open air. These investigators thought they had proved their non-deflection by a magnet, which would place them on the same footing as Rœntgen rays. S. Meyer and E. R. von Schweidler found that in a plane normal to the field the rays are probably deflected along circular arcs, while they are not deflected at all when proceeding in the direction of the field. This would place them on a par with cathode rays. H. Becquerel himself, operating with a small quantity of radio-active barium, has succeeded in bringing out some very important and interesting magnetic properties of the rays named after him, which will aid us in forming some idea as to their nature. In one of his experiments a small piece of the radiant substance, wrapped in aluminum foil, is placed in the centre of an iron disk forming one pole-piece of a strong electromagnet. The other pole-piece carries a fluorescent screen. When the magnet is not excited, a faint and widely dispersed luminosity is found on the screen. As soon as the magnet is excited, the luminous area contracts and becomes more intense. It is immaterial how the magnet is excited, as a reversal of the poles does not affect the result. Sensitive plates show the increase of intensity very clearly. With a distance of 15 millimetres between the pole-pieces, a strongly-marked negative is obtained in a minute and a half. This is probably the shortest time in which a Becquerel-ray impression has yet been obtained. Whether uranium rays can be concentrated in this manner remains to be seen, but if they can, a comparatively cheap source of good Becquerel rays will have been obtained. When the rays pass across the magnetic lines of force, and not along them, they behave in a very different manner. Becquerel places a bit of the substance midway between the two poles of the magnet, and a fluorescent or photographic plate across between the two poles. The result is very singular. An impression is produced just under the radiant substance, of course, but not round about it. Another impression extends in a curved line from pole to pole, curving out of the way of the substance in the middle, the convexity being towards the right in looking along the lines of force. The author believes that the rays proceeding upwards from the body are curved round like projectiles and impinge upon the plane of the screen from above. A lead screen can be placed between the source and the impression without dimming it, so long as the rays curve round it. So far as they go, the properties described are analogous to those of cathode rays.

ELECTRIC FANS AND FAN MOTORS FOR 1900

(Concluded from page 168.)

In last week's issue of the ELECTRICAL REVIEW a number of types of electric fan-motors were illustrated and described. It was found impossible adequately to cover the ground in the limit of space permissible in one issue of this journal. The descriptions and illustrations are therefore continued below, the two articles taken together forming perhaps the most comprehensive review of the electric fan industry in America that has ever been published.

It must not be forgotten, however, that these descriptions cover only such types of fans as are ready and whose manufacturers are prepared to put them on the market for the coming season. During the next few months many other types will be developed and the industry which already has assumed large proportions will unquestionably maintain the growth that has marked it for the last decade. There is scarcely any place in which American ingenuity has shown itself with more satisfactory results than in the design and construction of these little and important adjuncts to comfort.

A most singular thing about the fan-motor business is that it is not only an American product, but has also been confined entirely to this country in its development. So far as we know there are no fan-motors—certainly none of the desk and ceiling type—built abroad. But Europeans, Asiatics, Australians and Africans, and especially South Americans, like to keep cool. This fact is a tip that our fan makers should appreciate. Why not vigorously extend the sale of fans in foreign countries?

Westinghouse Fan-Motors.

The Westinghouse Electric and Manufacturing Company have prepared a special line of fan motors for the coming season, suited for both alternating and direct-current circuits. The alternating-current fan motors, shown in Fig. 1, is of the induction type. The four-blade fan is 13 inches in diameter, and is protected by a substantial guard of a graceful design. The motor presents a neat and pleasing appearance; the base and housing being finished in black japan and the fan and guard in bright brass. The motor, complete with attachments, weighs, 25 pounds; the outfit including fan, fan-guard, flexible cord and attachment plug, which make it ready for use.

The motor may be run at variable speeds. At full-speed a strong, steady and well distributed blast of air is supplied, and at moderate speed a gentle breeze is produced, suitable for a sick room, bed room or for office use. These motors can be used on circuits of 7,200 and 16,000 alternations, and for 50 and 100-volt service. The current consumed is approximately, at full-speed, 4 amperes on 50-volt circuits, and 2¼ amperes on 100-volt circuits; at moderate speed, 1.4 amperes on 50, and ¾ of an ampere on 100-volt circuits.

The field ring is built up of thin, soft steel plates, with inwardly projecting teeth, to which the field winding is applied. The armature is laminated, being built up of steel disks, slotted to receive the bare copper conductors. No insulation is needed, and consequently there is nothing to burn out. The motor has neither commutator nor brushes.

The Westinghouse fan-motor for direct-current circuits possesses a neat and compact form, and is entirely enclosed and protected, as is shown in Fig. 2. The cylindrical shell or housing is made of lacquered brass. The complete outfit weighs 23 pounds, and includes fan, fan-guard, flexible cord and attachment plug. The motor is intended for 110-volt circuits, but it may be operated on circuits having any voltage between 100 and 125. The current taken by the motor is approximately one-half an ampere at full speed, one-third of an ampere at medium speed, and one-fifth of an ampere at low speed.

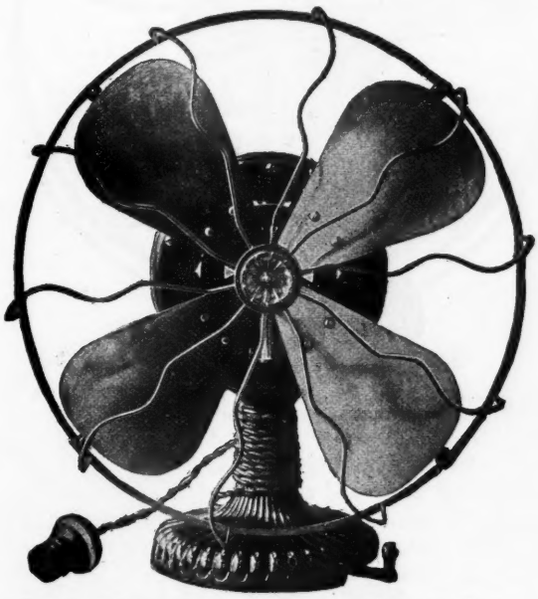


FIG. 1.—WESTINGHOUSE ALTERNATING-CURRENT DESK FAN MOTOR.

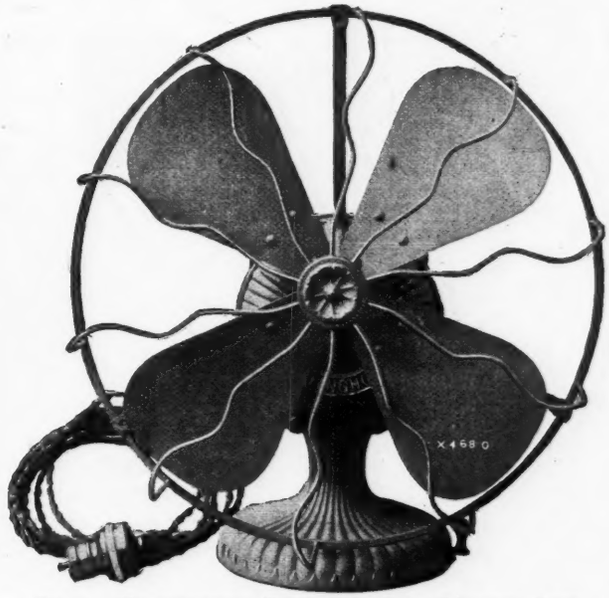


FIG. 2.—WESTINGHOUSE ENCLOSED DIRECT-CURRENT DESK FAN MOTOR.

The cores of both armature and field are made of high-grade laminated steel. The use of laminated steel in the field contributes largely to high efficiency and excellent performance in this kind of motor. The field winding is divided into two parts, which allow different arrangements to be made for variations of speed by means of a switch in the base of the motor. Three different speeds may be provided which are approximately 1,500 1,000 and 500 revolutions per minute, graduating the breeze over a very wide range.

The mechanical construction is simple and substantial. The end brackets carrying the bearings are bolted securely to the field core, thus insuring the accurate centreing of the armature in the field. The armature coils are wound in partially closed slots, which protect and support the winding. The absence of band wires is an important feature of the armature, the winding being held in the partially closed slots by strips of insulating material placed near the top of the slot.

Warren Electric and Specialty Company's Fans.

The illustration shows a very neat type of wall-bracket fan made by the Warren Electric and Specialty Company, Warren, Ohio. The case for the armature and the covers of the field spools are made of brass and highly polished. The motor part, as the illustration well shows, is mounted in trunnions on the fork, which may be revolved in its socket and set in place by the screw at the lower part of the figure. By means of this adjustment the fan once in position on the wall can be turned up or down or to any part of the room in which it is installed. This type of fan is made for direct current only.

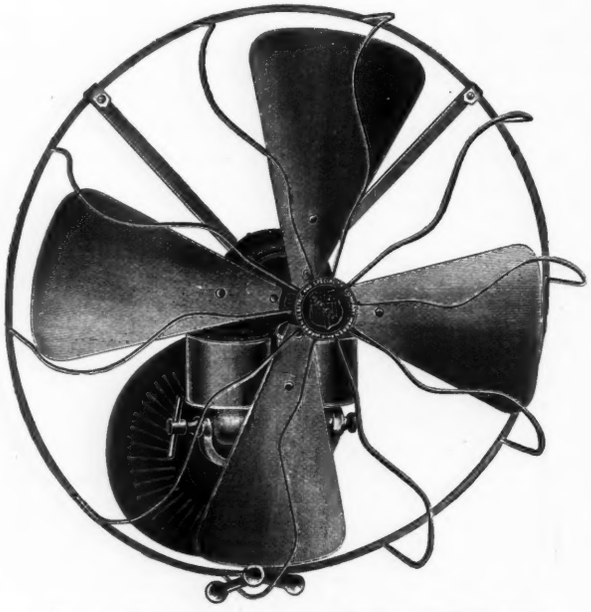


FIG. 1.—WARREN ELECTRIC AND SPECIALTY COMPANY'S BRACKET FAN-MOTOR.

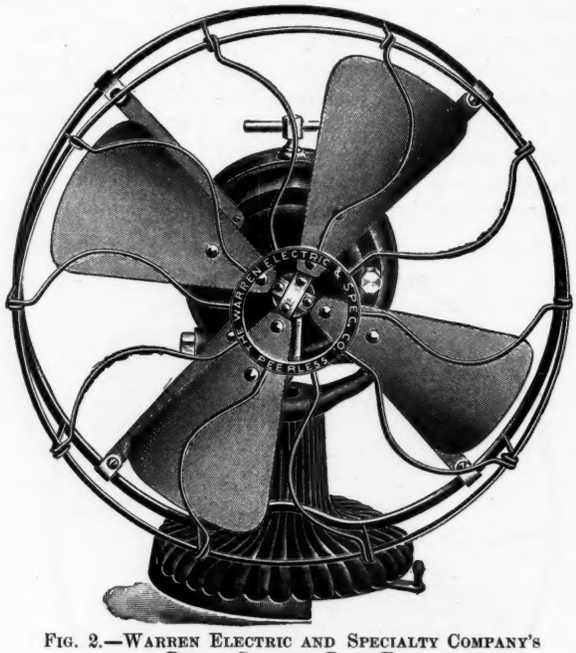


FIG. 2.—WARREN ELECTRIC AND SPECIALTY COMPANY'S DIRECT-CURRENT DESK FAN.

General Electric Fan-Motors.

The illustrations on opposite page show some types of General Electric fan-motors for 1900 which were not illustrated in the description given in the ELECTRICAL REVIEW of February 14, 1900. Fig. 1 shows a swivel-base fan for alternating-current circuits, the motor being supported in trunnions in the fork of the base. This method of mounting permits the axis of the fan and consequently its blast of air to be directed in any way that is desired.

Fig. 2 shows the back or commutator end of a direct-current desk fan-motor, having the rear casing removed in order to show the improved brush holders. As was described last week, the notable feature of these holders is the use of a rectangular brush which wears evenly to the surface of the commutator, and can not turn around so as to expose sharp edges to the copper surface. It is, in effect, a miniature of the form used extensively on large power machines. Fig. 3 illustrates a suspension for a fan-motor of either the direct or alternating type which is intended to be used in rooms where more attention is paid to ornament and decoration than in those where the ordinary wall-bracket form would be satisfactory. The hook upon which the motor is suspended has a highly ornate polished surface, and the spring suspension is such that the noise and vibration of the motor are completely damped away. The beauty of this combination is easily evident from the illustration.

Fig. 4 shows a number of the ceiling fan-motors made by the General Electric Company, these being constructed to operate on all standard voltages of direct-current and also upon the usual voltages and frequencies of alternating, single-phase current as supplied in American cities.

Backus Electric Fans.

The ceiling fans manufactured by the Backus Water Motor Company, of Newark, N. J., have been known for many years and have received the careful attention and standardization which is only possible when large numbers of such machines are manufactured and carefully improved from year to year. They are intended for direct current at the usual standard voltages from 110 to 500 volts, and all are constructed so that two speeds may be had by simply turning a switch. This switch can be, if desired, attached to the lowest point of the case. The peculiarity of the construction of the motor is the hollow steel shaft through which passes a stationary steel rod attached to a switch at the top. The motor has but this one bearing, which is lubricated by means of grease put in when the fan is shipped from the factory. Hence no oil is re-

FIG. 1.—BACKUS CEILING FAN FOR DIRECT CURRENT.

quired during its operation. The illustration, Fig. 1, shows a fan of the standard type, adapted for ceiling use. The body is of brass and is supplied in a number of different finishes. The blades are set at an invariable angle which is best for general service, and a simple turn of the button at the lowest part of the case starts the fan at slow speed or high speed or stops it. Fig. 2 is a larger view of the ornamental embossed brass cover used with the Backus ceiling fans.

FIG. 2.—ORNAMENTAL CASE OF BACKUS CEILING FAN.

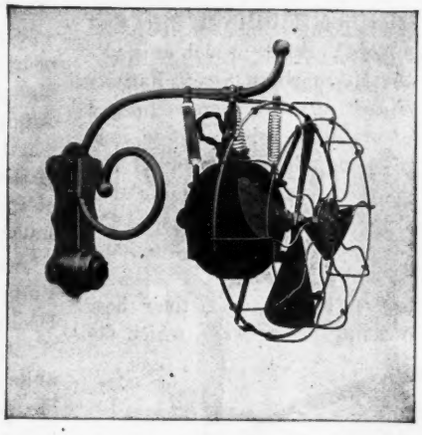


FIG. 3.—GENERAL ELECTRIC SUSPENSION FOR SMALL FAN-MOTOR.

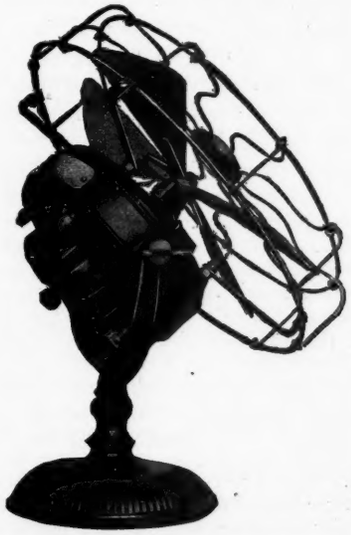
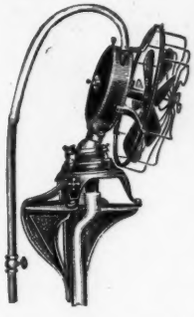


FIG. 1.—GENERAL ELECTRIC SWIVELING ALTERNATING-CURRENT FAN-MOTOR.

Water-Motor Fans.

So great has been the convenience and utility of the electric fan that, in many situations where electric currents are not available for the operation of fan motors, there has been a strong desire to utilize some other motive power for driving little fans. A somewhat curious and very ingenious development of this is illustrated in the accompanying figure, which shows the water-power fan motor made by the A. Rosenberg Company, of Baltimore, Md. Its action is sufficiently evident from the cut. The case of the jet motor is adapted to be tilted by means of a ball and socket-joint through a number of positions, and the discharge and entry pipes are both well shown by the illustration. The motor carrying a 12-inch fan consumes about three quarts of water per minute at ordinary hydrant pressure, and is said to be very efficient and satisfactory in operation.

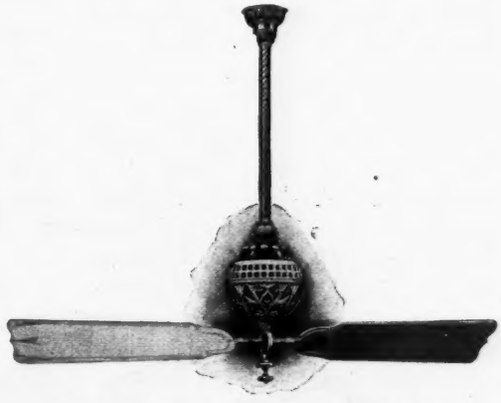


A WATER-MOTOR FAN.

FIG. 2.—REAR VIEW OF GENERAL ELECTRIC DIRECT-CURRENT DESK FAN, SHOWING BRUSH HOLDERS.

Tuerk Alternating-Current Fans.

Herewith is shown an illustration of the Tuerk standard alternating-current ceiling fan, made by the Hunter Fan and Motor Company, Fulton, N. Y., and marketed by the Western Electric Company, of Chicago, and E. B. Latham & Company, of New York. This apparatus was one of those originally designed for this character of service and has been modified and improved from year to year until the styles



TUERK ALTERNATING-CURRENT CEILING FAN.

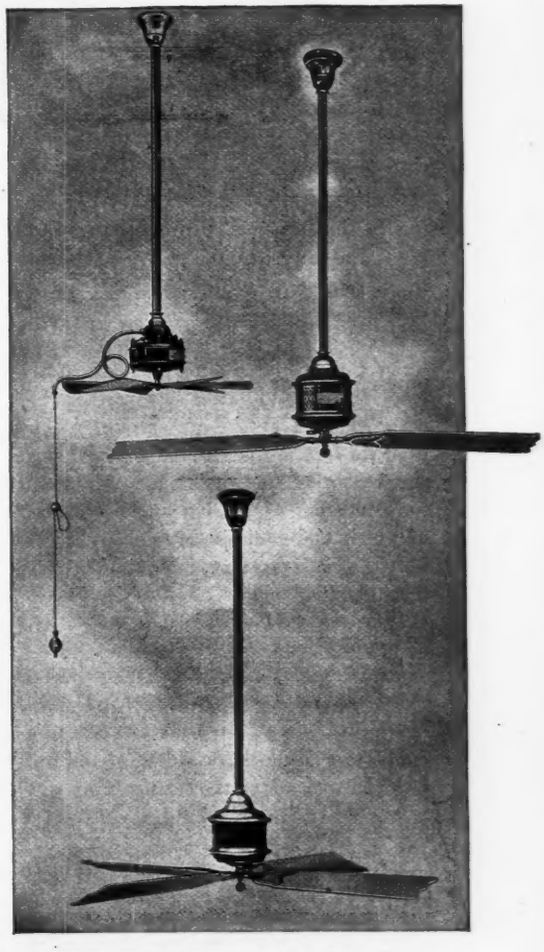
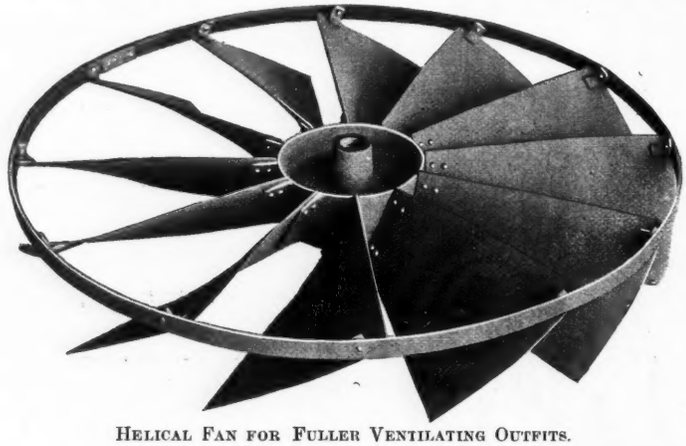


FIG. 4.—GENERAL ELECTRIC CEILING FANS.

produced this year represent the highest development. The motors are of excellent mechanical and electrical construction, made for 52 to 120 volts, and 50, 60, 100 and 125 cycles, with 152 revolutions per minute of the fan. These Tuerk alternating-current fans are produced in various artistic finishes and designs.

Fuller Fans.

The illustration shows excellently the type of helical blade fan made by the Fuller Company, of Detroit, Mich. It is readily recognized, even by those unfamiliar with fan work, that simply churning the air with a fan of improper design may be very wasteful of power without resulting in the satisfactory propulsion of the air. The fan blade illustrated is intended to operate at very high efficiency and it will be seen that each element of its blade is a true helical curve similar to that of a screw thread. The differing slant of the blade from tip to hub is so contrived that every element of the air encountered by it in its rotation is screwed forward with equal velocity, the whole blast coming out solid in front of the fan and not a mass of whirls and eddies as would be the case were the blades straight or of similar curve throughout.



Helical Fan for Fuller Ventilating Outfits.

PERSONAL.

Mr. Joseph E. Lockwood, president of the Michigan Electric Company, Detroit, Mich., was in New York, during last week.

Mr. Geo. Bullock, president of the Bullock Electric Manufacturing Company, Cincinnati, Ohio, has been in New York for the past two weeks.

Mr. Frederick A. Scheffler has resigned his position as general factory manager for the Sprague Electric Company in order to enter upon another business engagement.

Mr. A. M. Bullard, formerly traffic manager of the Chicago Telephone Company, has resigned in order to enter the service of the American Bell Telephone Company, of Boston.

Fire in the Metropolitan Street Railway Company's Car Barns.

One of the group of buildings occupying the entire block from Sixth to Seventh avenues, and from Fiftieth to Fifty-first streets, in New York city, which are occupied by the Metropolitan Street Railway Company, and 40 cars were damaged and three cars destroyed by fire on February 19, causing a loss of $75,000. The fire started in a repair shop of the electrical division on the second floor of the Fifty-first street end of the building, and was first seen by a policeman.

The firemen had to drag their hose through winding passageways, which delayed them and made necessary the sending out of a second alarm. They were afraid that the flames might get up the elevator shaft to the upper floors, which are used as carpenter and paint shops, and are filled with highly inflammable material. After half an hour's hard fight the firemen succeeded in subduing the blaze, having prevented the fire from spreading beyond the second floor.

New York Electric Vehicle Transportation Company.

The New York Electric Vehicle Transportation Company, which has been for some time past operating the public electric cab service in New York city, has secured handsome quarters at 541 Fifth avenue, at the corner of Forty-fifth street, in the new Lorraine building, as a show room for electromobiles. The company will enter the business of selling electromobiles of all types at retail, beside carrying on the cab service as heretofore. Possession of the new quarters will be taken during the current week, and within a short time vehicles representing about 10 types will be on view. The company has also secured a new repository and charging station for electric cabs at Fiftieth street and Eighth avenue.

BUSINESS NOTES.

The Sterling Electric Company, Chicago, has removed its offices from 71 and 73 West Adams street to 1260 Monadnock Building.

A storage shed to cost $150,000 is to be built by the Westinghouse Electric and Manufacturing Company in East Pittsburgh. The structure will have a total length of about 540 feet and will consist of three bays that will give a total width of 327 feet. Eight electric cranes will travel the entire length of the building.

The Crocker-Wheeler Company, New York, has just closed a contract with the Dixon Crucible Company, of Jersey City, N. J., for two 100-kilowatt generating units and about 300 horse-power in motors, for its works in Jersey City. These works, for the manufacture of graphite and plumbago products, crucibles, lead pencils, etc., will be equipped throughout with electrical power transmission. The Crocker-Wheeler Company has also established a new office at No. 610 English-American Building, Atlanta, Ga., where Mr. Louis P. Hale will make his headquarters as representative for the southern states.

The Emerson Electric Manufacturing Company, of St. Louis, Mo., are making a rather unusual proposition to the electrical trade, offering to send to any electrical dealer or central station of financial responsibility, a sample of their desk and ceiling fans for alternating current, on the following terms: Transportation charges on the samples are to be prepaid by the Emerson Electric Manufacturing Company, and the samples are sent with the understanding that if for any reason, the motors are not satisfactory, they might be returned within 30 days, the Emerson Electric Manufacturing Company paying the return charges. This gives any electrical dealer or central station the opportunity of inspecting and testing the latest product of the Emerson factory, with absolutely no expense or liability whatever. The Emerson Electric Manufacturing Company request firms desiring samples to order them on this basis, being careful to specify the exact voltages and alternations of the circuit on which the motors are to be tested.

OBITUARY.

Mr. John B. Oltman, who was fatally injured by a fall at the New York Athletic Club last week, is said to have received the first message sent over the transatlantic cable. Mr. Oltman, who was of German extraction, began life as a telegraph messenger boy, learned to be an operator, and at the time of his death was a member of the Stock Exchange and had amassed a considerable fortune.

A New Enclosed Arc Lamp.

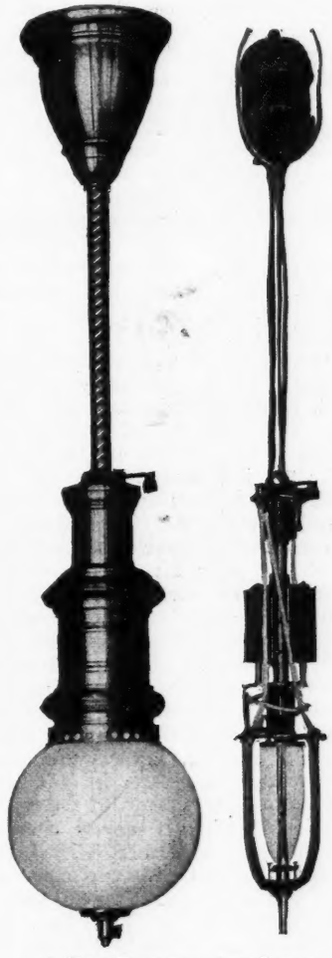
The arc-lamp field, it seems, is not all threshed out yet, if the claims made for one recently brought out by the Continental Electric Company, of Boston, Mass., can be substantiated. It is of the direct-current, constant-potential type, with enclosed arc, and the claims for superior efficiency are based on the peculiar system of regulation which has been adopted in the lamp accessories. In a ceiling canopy above the lamp, there is a queer looking coil of insulated copper wire with a long core of iron wires, whose projecting ends are bent backwardly towards the centre outside, seemingly conforming to the theoretical lines of force. The coil is of uncouth appearance on this account, but the canopy conceals it completely. The makers call it an "inductance coil," and it is connected in parallel with the lamp-magnet windings, with the result, they say, that wave fluctuations of current lag in the inductance coil and lead in the lamp-magnets. Consequently the lamp-magnets are operated by a current which fluctuates ahead of the fluctuations which might occur at the arc, and the arc is lengthened or shortened in time to check the fluctuations at the arc, without using the ordinary "dead resistance." Therefore, the makers say, they are able to devote nearly all the available energy to the arc itself, getting an arc twice the usual length and holding it very steady, even with great variations of pressure on the mains.

They give the following data for their standard lamp. With 112 volts on the mains and 4.5 amperes of current flowing they utilize 100 volts in the arc, which is then about ¾ inch long, against, as they assert for other makes of lamps, 80 volts at the arc from 112-volt mains, and 5 amperes flowing through the lamp, giving only a ⅜-inch arc. Such differences account for the superior results claimed, such as gain in light, gain in efficiency and saving of non-light-producing energy. The lamp holds a quiet arc between 90 and 120 volts, which is a very wide range, considering there is no adjustment provided in the mechanism.

Owing to the extremely small shadow cast by the negative carbon the outer globe is intensely bright all over, and no shadow whatever is found under the lamp. It is very striking to see a lamp with a steadily maintained arc three-quarters of an inch long and note the absence of the flickering which is so trying to the eyes.

The Continental Electric Company also makes a constant-potential lamp which burns with 97 volts at the arc when taking current from 112-volt mains, consuming three and three-quarter amperes. This also maintains a long arc and has the same features of regulation as above.

If the claims made for this lamp are borne out, it should command a good business in the enclosed arc market, which latter promises to grow to greater proportions than any other mode of arc-lighting. The extensive department store of R. H. White Company, of Boston, is entirely lighted with these lamps, some 400 in all, and the illumination is very fine.



A New Enclosed Arc Lamp.

American Electro-Therapeutic Association.

The American Electro-Therapeutic Association will meet in New York city on September 25, 26 and 27, 1900, the meetings being held in the hall of the Academy of Medicine, at No. 17 West Forty-third street. Dr. Robert Newman is the chairman of the committee on arrangements and may be addressed for information at No. 148 West Seventy-third street, New York city. It is expected that a number of valuable and interesting papers will be presented at the meeting.

Earthing Alternate-Current Mains.

The advantage of earthing one conductor of an alternate current system of high-tension distribution is so great that it has been adopted in practically all the important electric lighting stations in England using alternating currents. When concentric cables are used the outer conductor is always the one to be earthed, as this naturally tends to keep itself at earth potential. Of course, when this is done, an earth on the inner conductor means practically a short-circuit on the system, which has to be removed before the supply through the defective part can be continued. In spite of this, we believe, says the London *Electrical Engineer,* that the interruption of the supply is less than in systems where an attempt is made to keep both poles insulated from earth. When this is done, the conductor whose insulation resistance is least tends to keep at earth potential. An earth, then, on the other conductor immediately strains the defective insulation on the first, and a breakdown occurs in which both conducting wires are disabled. An example of this recently took place at Hastings. Again, when one conductor is permanently connected to earth at the central station, the voltage set up by the resonance effects is not likely to be quite so destructive as when both the wires are insulated.

LIGHTING NOTES.

The Edison Electric Company will supply to Santa Ana, Cal., electricity generated by Santa Clara River power in the San Bernardino Mountains, 100 miles away. Electricity from the same source has been transmitted 83 miles to Los Angeles.

At the annual meeting of the stockholders of the Edison Electric Illuminating Company, of New York, the following board of directors was elected: Hugh J. Grant, A. F. Brady, Thomas E. Murray, Louis B. Gawtry, Frank Enos, R. A. Carter, Alfred B. Thatcher, Wm. H. Bailey, Henry J. Hemmens, John W. Lieb, Jr., James S. Connell, Henry Morgenthau and Michael F. Phelan.

The most important local electric business transaction for many years has been closed in Santa Cruz, Cal. The Big Creek Power Company interests have been sold to F. W. Billing and J. Q. Packard, a capitalist and mine-owner from Salt Lake City. The consideration was $250,000 cash. This big plant supplies the power for the operation of the incandescent and arc light system, the electric railroad and the California Powder Works.

The Decision of Judge Acheson in the Carty Telephone Case.

The motion for a preliminary injunction in the suit of the Western Electric Company, of Chicago, against the Anthracite Telephone Company, of Hazleton, Pa., for alleged infringement of the Carty bridging-bell patent (No. 449,106), argued before Judge Acheson, of the United States Circuit Court, in Pittsburgh, was decided on February 12, 1900, the injunction being refused. The independent telephone companies consider this quite a victory against the Bell interests represented by the Western Electric Company. The decision is as follows:

This suit is upon the Carty patent, No. 449,106, for improvements in telephone circuit and apparatus. Infringement of the first, fourth, fourteenth and fifteenth claims is alleged. The defendant company is the mere user of telephonic apparatus purchased in good faith in the market from responsible manufacturers. The case is before the Court upon a motion for a preliminary injunction, and has been heard upon numerous *ex parte* affidavits on one side and the other.

After much reflection it is my conviction that a preliminary injunction should be denied here, notwithstanding this Court sustained the patent in the case of Western Electric Company *vs.* Millheim Electric Telephone Company, 88 Fed. Rep., 505, upon final hearing, and the decree therein was affirmed by the United States Circuit Court of Appeals in Millheim Electric Telephone Company *vs.* Western Electric Company, 95 Fed. Rep. 152.

Upon the face of the Millheim case there are peculiar features. In the Circuit Court, Judge Buffington in his opinion said: "The defenses are lack of novelty and patentability. These defenses failing, infringement is conceded." Under this confession of infringement it became unnecessary for the Circuit Court to construe the patent, and although it has no less than fifteen claims, no intimation of opinion on that subject was given. Nor was there an adjudication with respect to any particular claim. The decree as to infringement was in general terms, and evidently was based upon the defendant's concession. Judge Buffington's opinion shows, too, that the defences of lack of novelty and patentability were vested altogether on certain prior patents and publications.

In the Court of Appeals, Judge Kirkpatrick, in delivering the opinion of the Court, said: "Infringement is charged in the bill and not denied, except in the unverified answer. Complainant's witness, after examination of the defendant's system, testified that it was constructed and organized completely in accordance with the instructions contained in the patent in suit. Though these facts were peculiarly within their own knowledge, the defendants offered no contradictory evidence bearing on the question." The Court of Appeals had no occasion to construe the patent or any of its claims and did not do so. The opinion of the Court, however, contains this significant passage: "So far as the record shows, there was no anticipation of this device. All the elements of the combination had been used before, and the functions of each were well-known in the art, but it does not appear that they had ever been similarly combined for effectuating the purpose here accomplished."

In the present case it is shown that the defendant, The Anthracite Telephone Company, does not use the specific apparatus described in the Carty patent. The plaintiff's principal electrical expert admits deviations, but expresses the opinion that they are of no practical importance. The defendant's electrical experts, however, express quite a contrary opinion, and their views, that the differences are radical, are supported by citations from the testimony of Carty himself in the Millheim case, and otherwise. The question of infringement involved in this case is altogether new, and, in my judgment, is a serious one. The solution depends upon the construction to be given to the Carty patent, and that construction involves an investigation of the prior art. I am then of opinion that the Court, acting upon more *ex parte* affidavits, should not undertake to decide the question at this preliminary stage of the case. The considerations which led to a denial of a preliminary injunction in the case of the Union Switch and Signal Company *vs.* Philadelphia & Reading Railway Company, 75 Fed. Rep. 1004, are, in the main, present here. In support of the refusal to enjoin preliminarily may be cited the rulings in Carey *vs.* Miller, 34 Fed. Rep. 392, and Sprague Electric Rig and Motor Company *vs.* Nassau Electric Railway Company, 95 Fed. Rep. 821. In the latter case it was held by the Circuit Court of Appeals of the Second Circuit that where the question of infringement is a doubtful one and the plaintiff's contention requires a broader construction of the claims of the patent than they received in prior adjudications, such question should not be determined on a motion for a preliminary injunction, but should be reserved until final hearing of the cause. That this is the proper course here, seems clear to me.

But then, again; the defense of prior actual public use at Crown Point and Merrillville, Indiana, and on the Wilmington Coal Company's line in Chicago, is here set up, and is supported by affidavits of three witnesses, whose statements are positive and circumstantial, and, if true, seem to make out the defense. These statements are corroborated by the affidavits of other witnesses and also by alleged contemporaneous writings. On the other hand, the plaintiff produces counter-affidavits tending to discredit the defendant's witnesses as to the alleged prior use. Upon these conflicting affidavits it would scarcely be safe for the Court to undertake to determine what the truth of the matter is. Enough, however, here appears to justify a refusal of a preliminary injunction unless the adjudication in the Millheim case is to be considered as conclusive against the defense of prior use at this preliminary stage of the case. But the proofs before the Court disclose circumstances connected with that adjudication which, I think, ought to deprive it of that effect. It appears that the American Bell Telephone Company was and is the owner of more than one-half of the capital stock of the Western Electric Company, the plaintiff in the Millheim case and in this suit, and that by virtue of such controlling ownership, and also by reason of contract relations between these companies, said two companies were and are jointly interested in this litigation on the Carty patent, their common interest being to sustain the patent. Now it further appears that pending the suit in the Millheim case the local representative of said Bell Telephone Company, acting in the interest of that company and for it, bought out the Millheim Electric Telephone Company and all its property. The negotiations for this purpose began in January, 1898, the terms of sale were settled on February 10, and the transaction was consummated by transfer and delivery of possession in March, 1898, when the alleged infringing apparatus was taken out of the Millheim lines and replaced by other apparatus.

It seems to me from the evidence that a real controversy between the Western Electric Company and the Millheim Electric Telephone Company no longer existed when the Millheim case was heard in the Circuit Court on February 17, 1898. Certainly there was no such dispute when that Court made its decision on July 18, 1898. It may, I think, be affirmed confidently that if the learned judge who sat in the Circuit Court had known the facts he would not have heard or decided the Millheim case, and that the Court of Appeals would have dismissed the appeal had the facts been brought to its notice. Lord *vs.* Veazie, 8 How. 251; Cleveland *vs.* Chamberlain, 1 Black (U. S.) 419; East Tennessee & Railroad Company *vs.* Southern Telegraph Company, 125 U. S. 695.

It is proper for me to add that the Court disclaims any intention to reflect in any wise upon the counsel who conducted or argued the Millheim case. Undoubtedly the counsel were uninformed that the suit had ceased to be an adversary proceeding.

The motion for a preliminary injunction is denied.

A decision on the merits of the case will probably not be reached for three or four months, as time has been granted for taking proofs. The attorneys for the Western Electric Company were F. P. Fish and Geo. P. Barton; for the opposition, Charles C. Buckley, Judge R. S. Taylor and Arthur Stewart.

A New Type of Carbon Cylinder Cell.

The new type of carbon cylinder primary battery cell illustrated herewith possesses some extraordinary features of novelty and simplicity Its construction is evident from Fig. 1, which shows a cross-section of the carbon cylinder and the central rod of zinc. The cylinder of porous carbon contains an annular space between its double walls, which is filled with the depolarizing material. Sal ammoniac solution is used as the exciting fluid.

The curves shown in Fig. 2 represent the discharge and recuperation of this cell as compared with the ordinary carbon-zinc element without depolarizing material. The dotted line shows the performance of the ordinary type and the full line that of the double-walled carbon cylinder with depolarizer. It is remarkable that after a dead short-circuit of an hour this battery still gives an output of one ampere. There is no doubt but that this new cylinder cell will meet with the greatest favor among construction men who guarantee their work as a rule for 12 months, for judging from the curves, a temporary short-circuit of these cells for a short time would not injure them as with the ordinary type, which are useless after a short circuit. Physicians will also find this cell of great value for general therapeutic work, where the service is often severe, and it is of vital import that the battery will not readily polarize.

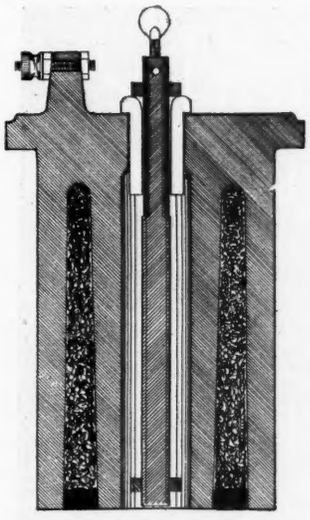


FIG. 1.—CROSS SECTION OF ELEMENT OF A NEW TYPE OF CARBON CYLINDER BATTERY CELL.

In general appearance the Duplex cylinder is the same as the ordinary type, the difference being, in the Duplex the walls are hollow, and this hollow space is filled with a special depolarizing mixture which, when exhausted after long use, can be removed, and the purchaser still has a cylinder carbon that is far superior to the ordinary type.

FIG. 2.—WATERPROOF RECEPTACLE, SHADE AND GUARD.

These cells are manufactured by the National Carbon Company, of Cleveland, Ohio.

The citizens of Elkader, Iowa, voted on Tuesday, February 13, to grant a franchise for an electric light and power plant to Messrs. Schmidt Bros. & Company, of that city. The power will be furnished by turbine wheels together with a reserve steam plant. Mr. H. L. Griffith, of Elkader, Iowa, is acting as consulting engineer and will prepare the specifications.

An European Design of Weatherproof Receptacle and Shade.

The illustrations herewith represent a porcelain weatherproof receptacle and shade made in Austria and imported for the American trade by Schiff, Jordan & Company, New York city. There are many points of interest connected with this piece of apparatus, particularly on account of its differences from the ordinary American types in use. The receptacle is made from what is claimed to be the best grade of Austrian porcelain and is said to be very practical and entirely damp-proof. For railway stations, breweries, chemical factories, tunnels and all locations where the lamps are exposed to rain, steam, dampness of acid fumes, this combination is especially effective. The iron shade is rigidly attached to the porcelain part, but all the various pieces of the fixture are readily disconnected for adjusting the lamp. The wiring connections are very simply and easily made.

FIG. 1.—WATERPROOF RECEPTACLE.

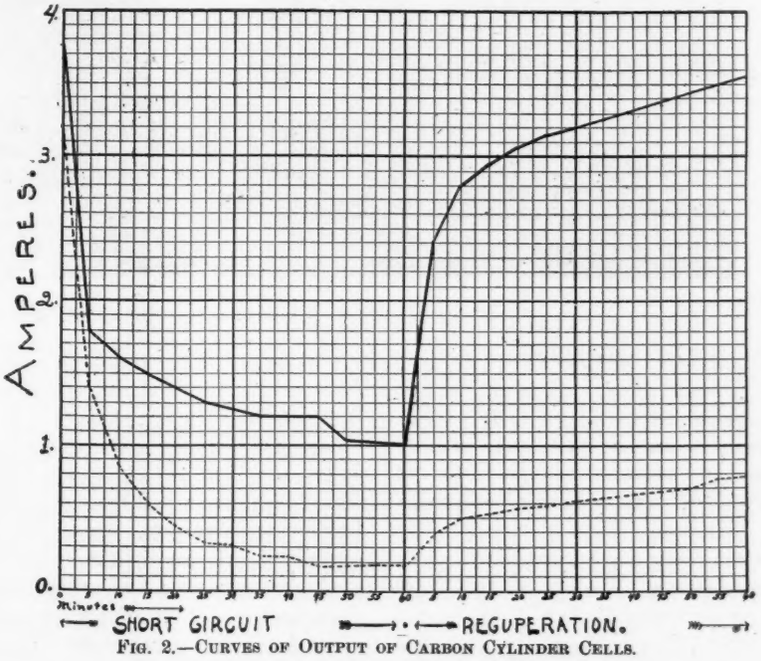


FIG. 2.—CURVES OF OUTPUT OF CARBON CYLINDER CELLS.

Wall Street and the Electrical Stock Market.

The market of electrical securities remained about the same at the close of the week as at the end of the previous week. Industrials apparently are not looked upon with the favor as permanent investments as are the stocks of the steam railroads. The large dividend declared by the American Steel and Wire Company recently was followed last week by the announcement that the Federal Steel Company would pay, on March 20, out of the earnings of 1899, a dividend of 2½ per cent on its common stock in addition to the 1¼ per cent paid January 20. These dividends, however, do not seem to have boomed the stock very much, American Steel and Wire, common, selling under 60, and the Federal Steel, common, at 55 and the preferred at 75. It is safe to predict, though, that there will be a gradual advance in the value of the stock of these companies until they take their proper place alongside of the older and better known properties.

The financial situation of the Third Avenue Railroad, of New York, is still considered quite serious and the large creditors are now endeavoring to take hold and protect themselves. It looks as though the Metropolitan Railroad would yet secure control of the Third Avenue and at a much lower figure than it is understood they offered to pay a year or two ago.

The financial outlook is very good. There is enough demand for money to indicate a healthy business, and the banks are discounting with a fair liberality.

On the New York Stock Exchange, General Electric closed the week at 127¾, a gain of 2¼ points. Metropolitan Street Railway, of New York, closed at 176¼ bid, a loss of 1¼ points. Third Avenue Railroad, of New York, closed at 97, a loss of 3 points. Brooklyn Rapid Transit closed at 72½, a loss of ½ point. Manhattan Railway, of New York, closed at 98, a gain of 1 point.

On the Boston exchange, American Bell Telephone closed the week at 339, and on the Philadelphia exchange Electric Storage Battery, common, closed at 90, Electric of America at 13, and Union Traction at 37.

Outside securities, New York, closed as follows: Electric Vehicle, 40; Electric Boat, 15, and Electric Axle, 4. In the matter of Electric Axle, this company and others have been consolidated under the title of the Consolidated Electric Light and Equipment Company, which company controls electric car lighting from axles, a refrigerating process securing power in the same way, and will supply other equipments for use by steam roads. Its stock is quoted at 13½ bid and 15 asked.

Wall Street, February 17.

The Bridgeport, Ct., Electric Light Company has sold its plants to the United Illuminating Company, of New Haven, for the consideration of $52,000 or thereabout.

Electric Car Lighting from the Train Axle.

In the ELECTRICAL REVIEW for January 24, 1900, an extended description was given of the apparatus made use of by the Electric Axle, Light and Power Company in the lighting of railway cars. On this page is shown an illustration of the interior of a postal car or railway post-office car, lighted with electric lamps by this system, the power being derived from the axle of the car itself when it is running above certain speeds and stored in an accumulator swung underneath the car. As the illustration shows, the car is brilliantly illuminated by a large number of incandescent lamps, their steady light rendering the work of the mail clerks easy on night runs. No other variety of railway vehicle necessitates such careful and particular lighting as these perambulating post offices, since the clerks employed in them have to sort mail at night and often decipher illegible addresses and read fine print on newspaper parcels. It is, therefore, necessary that they have an abundance of light of the steadiest kind and this desideratum is admirably furnished by the incandescent lamp, especially when operated from storage batteries, as is the case in this instance.

INTERIOR VIEW OF A U. S. RAILWAY MAIL CAR LIGHTED BY ELECTRICITY.

The N. N. Hill Brass Company, East Hampton, Ct., has recently issued a small illustrated catalogue and price-list of electric gongs and bells made in its factories.

The Rubber Industry of Sierra Leone.

The kewattia, or rubber tree of West Africa, is one of the most beautiful trees of the forest, growing usually to the height of from 40 to 60 feet. Its leaves are from four to nine inches in length by from one to three in width, oblong, and tapering towards the ends, supported by a stem from eight to nine inches long, says a report of U. S. Consul John T. Williams, at Sierra Leone, Africa.

There are also several species of vines which yield a grade of rubber inferior in some respects to that obtained from the tree; however, when gathered with care, this commands a ready sale.

The supply of Freetown market for the most part comes from the hinterlands of Sierra Leone and from the Foutah country in the French protectorate farther in the interior. That which comes from the Foutah territory is limited, owing to the export tax of three cents per pound placed by the French upon all rubber sold by natives outside of their protectorate. Notwithstanding this prohibitory restriction upon the native rubber venders, there are several regular traders who furnish to this market a good quantity of Foutah rubber every season. This rubber is almost invariably adulterated with clay, yet it grades well in the local market and brings a good price.

In former years, Freetown was a better depot for rubber than at present, but since the establishment of the French protectorate, which controls the output of the valleys of the adjacent northern rivers, the trade has been diverted to the French port of Konakry, 72 miles distant from Freetown.

The dry period from November until May is the gathering season. Native chiefs supervise and control the sale of the output of their respective territories. The method of gathering the sap is very simple. The body of the tree is tapped, and the juice flows until exhausted; later, new incisions are made. The juice is usually caught in cups or calabashes attached to the tree, so as to prevent impurities appearing in the rubber. The neglect of this precaution is responsible for a percentage of the incidental adulterations of otherwise good rubber, frequently found in the local market.

The native, in his efforts to increase his stock frequently bleeds the roots as well as the body of the tree; this is fatal to the tree. The product is known as "root rubber," and besides containing large quantities of impurities is very inferior to any grade of tree rubber, and would be refused altogether by local buyers, in order to discourage the destruction of the forest, were it not for the sharp competition for export trade.

The rubber is brought to market overland by caravans of natives, or, most frequently, by canoes. These cargoes are generally consigned to some particular agent, though often they are sold to the one making the best offer. For convenience rubber is arranged in three classes or grades, known as No. 1, No. 2 and No. 3, the character of the tissue and freedom from impurities being the determining factors, as well as the kind of adulterants. Considerable ability on the part of the agent is necessary to enable him to properly assort and select the rubber, and to detect adulterations. There are two classes of these—incidental and intentional. The former is the result of carelessness on the part of the gatherers, who do not use proper receptacles for the juice. Intentional adulterations are due to efforts to increase volume and weight by use of dirt, sand, bark and sometimes stones. Another species of fraud is the mixture of other non-elastic gummy substances with pure juice; still another is to soak rubber by placing it in pits close to the water for a long time. Rubber so treated is seriously injured in quality, and at the same time increased in bulk and weight.

The colonial authorities, as well as the chamber of commerce, are endeavoring, by proper instructions to those concerned, to discourage these abuses and to emphasize in every way possible the importance of improving the quality of the rubber brought to Freetown market.

There is being inaugurated by the Governor and officials a plan to foster the planting of rubber trees and vines in the colony. To this end they have caused to be issued pamphlets of instructions in regard to seeding, transplanting, etc., through the department of agriculture and horticulture. It is hoped that there will be a decided improvement as to quality and quantity of exports in the near future.

The value of rubber exported from Sierra Leone in 1898 was $255,512.35, of which the amount shipped to Germany was $33,618.51. The remainder went to England. The prices in the local market are controlled by Liverpool and Hamburg markets. The local prices for No. 1, No. 2 and No. 3 range between 60, 56 and 48 cents per pound. For No. 3 as little as 30 cents per pound is sometimes paid. The freight, handling, storage and costs of insurance in either Liverpool or Hamburg are usually estimated at from six to eight cents a pound. Agent's commission for buying and handling in the local market is five per cent gross.

The regular steamship communication from this coast to England and Germany makes shipping to those countries comparatively easy; and as local buyers are always ready to seize any favorable opportunity to convert their accumulated stores of rubber into ready cash, there is little or no inducements for them to seek other markets. For this reason, American dealers desiring to purchase rubber here would do well to establish agencies to buy for them.

Marconi's System in South Africa.

In a lecture before the Royal Institution, in London, a few days ago, says a news cable despatch, Mr. Marconi described the use of his wireless telegraphic apparatus in South Africa. He said that when he reached De Aar there were no poles and he therefore flew kites to which wires were attached. Success was erratic owing to the variability of the wind, a kite soaring at one station when there was no wind at another.

When poles were rigged he achieved a record, connecting De Aar and Modder River, which are 70 miles apart. The story that the iron in the hills interfered with the messages was nonsense. Two men volunteered to attempt to dodge the Boers and take the apparatus to Kimberly, but General Methuen refused to allow the men to go.

The War Office had been impressed by the success of the system, and was granting facilities which it was indisposed at first to grant. It was sending out numbers of small balloons to carry wires, enabling portable installations.

An Aluminum Solder.

A new solder for aluminum has recently been patented, which the inventor claims will melt at a low temperature, and will adhere readily to the aluminum, forming a surface which will not be attacked by moisture. The solder is composed of an alloy of tin, zinc and bismuth, the tin being largely in excess of the other constituents. With zinc chloride as flux, the solder can be used on brass, copper, nickel, iron and other metal.

Another step in the plans of the electric light combination was made lately at New Haven, Ct., when a mortgage of $2,000,000 was made by the United Illuminating Company to the New Haven Trust Company as trustees. The mortgage is given for 40 years, gold bonds, and bears date of February 1, 1900. The interest is four per cent. The revenue stamps on the mortgage amounted to $990.50.

VIEWS, NEWS AND INTERVIEWS

The remark that " an arc light is as good as a policeman," has often been made. It is believed, however, that one of the earliest appeals in modern days for more street lights as a protective measure, was made in a little pamphlet called "Cincinnati in 1826," by B. Drake and E. D. Mansfield. The book was published at Cincinnati in February, 1827. In speaking of the growth and progress of the city, the authors remarked:

"Heretofore there have been no other police officers in Cincinnati, than the regular ministers of law; but the Council, in compliance with the wishes of a respectable portion of the community, have recently established a City Watch, consisting of two Captains and eighteen men, at an expense of about $3,000 per annum. A watch, in a city of the magnitude of Cincinnati, is obviously of great importance; but it may be seriously doubted, whether the erection of a few lamps should not have preceded its establishment; for, in proportion to the increase of light, the facilities for the commission of crimes are lessened, and, of consequence, the means of detection rendered more numerous. A couple of lamps at each intersection of the streets, in those parts of the city thickly populated would add greatly to the comfort of the citizens, and the safety of their property."

The sudden stop made now by the cable cars at various streets says the New York *Sun,* are incomprehensible enough to passengers who have succeeded in getting on board only by the skin of their teeth and have good reason to wonder why in the world the gripman should voluntarily stop. Very few of them know that in the streets at which these stops are made are situated fire houses and that a recent ordinance requires this precaution to be taken to prevent possible collision between the cars and the engines. It is no mere outburst on the part of the gripman which leads him to pause.

Mr. Abbett, of Hudson County, has introduced a bill in the state legislature to substitute the electric chair for hanging in New Jersey. He asserts that public sentiment in favor of execution by electricity is growing rapidly, and that sooner or later the gallows will have to be given up.

A New Orleans business man recently gave a burglar the scare of his life by throwing incandescent lamps at him. The burglar must have thought a rapid-fire one-pounder gun had been trained on him, as he made tracks as rapidly as a jack-rabbit. It took the citizen a week to get the bits of glass out of his rugs and carpets.

The House Committee on Inter-State and Foreign Commerce, by a two to one majority, voted on February 13 in favor of the proposition to authorize the laying of a cable across the Pacific Ocean by an American corporation under contract for annual subsidy, as against the construction and operation of the cable by the Government. This decision was reached on a motion to take up the bill introduced by Representative Sherman, of New York, providing for the payment by the government of a subsidy of $400,000 annually for 20 years to an American company which will construct and operate the cable.

The electromobile is playing its part in New York city's daily life, as the following quotation from a newspaper will show:

Domenico Caffone, working on a building at 100th street and West End Avenue, quarreled with Frank Bradley, his employer, over the amount due him, drew a pistol and fired five shots at Bradley without hitting him. Then he pocketed his pistol and ran.

Policeman Woodin, who is large around the waist, ran after him, but was winded after three blocks up the avenue. An automobile came along in charge of a man with a gray beard.

"Jump in, officer," shouted the man, "and I will help you out."

The automobile was a tight fit, but Woodin crowded into the seat. Then the owner put on full power. The Italian ran to 113th street, where he was overtaken and arrested.

The other evening the electric lights of Juanita, Cal., failed, and the next morning three suits were instituted against the corporation. According to one of the lawyers in the case, "the parlor was at the time filled by guests at a children's party, many of whom made use of the opportunity for illicit kissing and romping, which resulted in the destruction of costly ornaments and was harmful to the moral welfare of those present."

The management of the electric railroad between Seneca Falls, N. Y., and Geneva, ever mindful of the interests of its employees, has issued an order allowing an extra motorman on all its cars. This is done for the purpose of protecting its men from the cold, as they will relieve each other at intervals during the trips.

ELECTRIC LIGHTING

The Consolidated Electric Light Company, of Burlington, Vt., has purchased a new 10,000-light generator to be placed at the gorge near Winooski, to take the place of a number of 2,000-light machines formerly in use.

At the regular annual meeting of the stockholders of the Lowell, Mass., Electric Light Corporation the following officers were chosen: Charles A. Stone, Edwin S. Webster, L. J. Webster, W. Cameron Forbes, Eliot Wadsworth, G. W. Lee, Francis R. Hart.

Municipal electric lighting has been abandoned by Council of Hatboro, Pa., and the borough plant has been sold. Hereafter the current will be supplied by the Jenkintown Electric Light Company, which has extended its wires from Willow Grove to Hatboro.

The Harper's Ferry, W. Va., Electric Light Company has begun to issue stock and petition adjacent counties for the right to place poles along the highway. The company, at an early date, will begin to harness the waters of the Shenandoah and Potomac and make them furnish power to run machinery in Charlestown, Sheperdstown, Martinsburg and Winchester.

The Consolidated Electric Light Company, of Montpelier, Vt., has erected a plant at a point on the Winooski River about fifteen miles north of Montpelier to furnish power and lights for Montpelier, Barre and Waterbury, Vt. The plant is equipped with modern appliances and has one of the best powers in Vermont. The plant is now working satisfactorily.

The stockholders of the Waynesboro, Pa., Electric Light and Power Company have reelected the following board of directors: F. Forthman, E. Elden, John J. Miller, Daniel Hoover, J. F. Zullinger, E. W. Washabaugh, J. F. Geiser. W. T. Omwake was reelected treasurer. The board will organize the first Monday in March. A semi-annual dividend of three per cent was declared, payable February 15.

Next Spring will witness the erection of one of the most complete light and power plants in the state of Pennsylvania. It will be located at Shamokin and be erected by the Shamokin Light, Heat and Power Company. The company was incorporated last year and absorbed the two electric and gas plants of that city. They will expend $250,000 obtained by issuing bonds for the erection of the plant.

"Universal" Junction Boxes.

In the wiring of buildings for electrical illumination, transmission of power, etc., there are many conditions that necessitate the use of individual junction boxes constructed especially for such emergencies. The latest invention, and one well adapted to all purposes, is the "Universal" junction box, just brought out by the Sprague Electric Company, of New York city, and shown in Figs. 1 and 2 herewith.

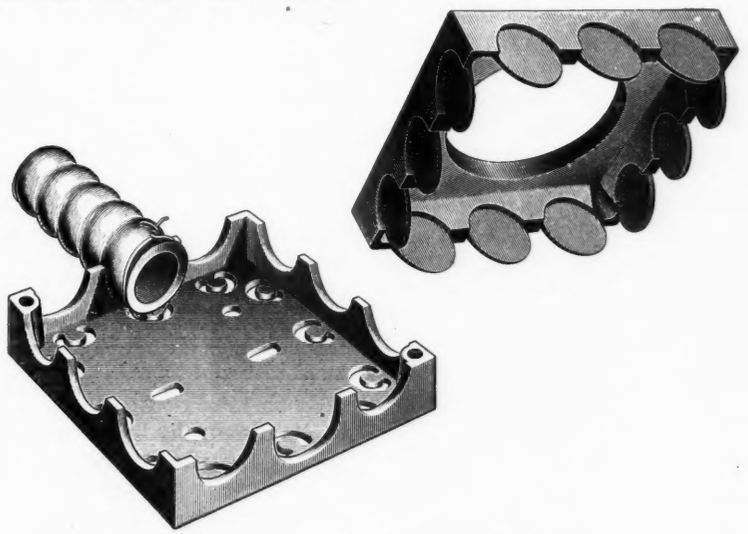


FIG. 1.—"UNIVERSAL" JUNCTION BOXES.

This box is so constructed that one, two, or more inleading conduits may be put in place by knocking out one or more tongues, making the requisite openings in the box. The bottom of the box has perforations permitting a wire to be inserted to tie the conduit in place while the work is in progress. This is a very important feature, and saves much time and expense.

These boxes may be applied to either ceiling or wall wherever a gas pipe passes through without the use of ceiling or wall blocks, or other means of attachment now ordinarily used.

The ceiling box shown in Fig. 2 can be secured to the gas pipe by a set screw. Fig. 3 illustrates a new type of pipe hook made by the same company. It has the advantage of being secured to the wall or ceiling by a screw or nail, without the danger of being broken by a false blow; in fact, it is said to be impossible to break it in such a manner. Fig. 4 shows the new lead bushing and expanding tool which the Sprague Electric Company is now making. The bushing has a thread cast on the outside and can be screwed into the end of the pipe and then expanded by inserting the expanding tool and giving it a few short twists to the right and left, but never turning it completely around.

New Electric Road in Buenos Ayres.

Mr. Carlos Bright, an American engineer, at No. 874 Cuyo street, Buenos Ayres, Argentina, has been granted a concession for an underground electric line in that city from the Southern Railway station to the Ritero, and from the Western Railway station to the Plaza Victoria. He has formed a company and information received says that work will shortly begin. The Anglo-Argentino Tramway Company, with offices at No. 3583 Rivadavia street, Buenos Ayres, has applied to the authorities for permission to change its traction to an electric system and make extensions. Though the majority of the electric railroads, and, in fact, most of the large undertakings in the Argentine Republic are backed by British capital, there purchases are made where it best suits their convenience and interest. It has often occurred that, even through British firms, orders for American products have been secured from the Argentine market, and at this time, when the engineering interests in Great Britain are so fully engaged with home work, the chances of securing contracts for foreign countries are good.

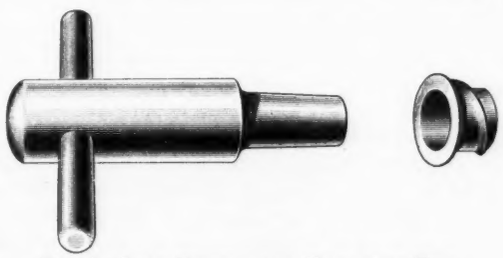


FIG. 4.—LEAD BUSHING AND EXPANDING TOOL.

A New Trolley Road at Tien Tsin, China.

Mr. Chrys Moller, formerly interested in a cable line in Sioux City, has returned to America from China, for the purpose of getting the equipment for an electric railway to connect the foreign quarter of Tien Tsin, China, with the native walled city of 1,000,000 inhabitants. English and Japanese capitalists have secured the franchise, which is the first for an electric railway in the Flowery Kingdom. The railway will be three miles in length and the street along which it will run is one of the most densely populated in the world. The Chinese, Mr. Moller says, have no objection to electric railways.

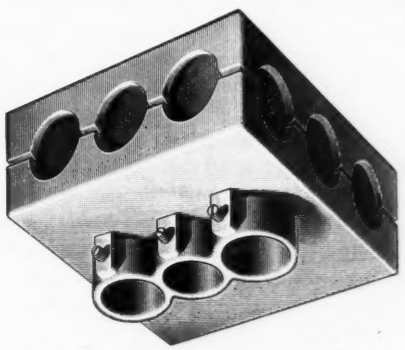


FIG. 2.—"UNIVERSAL" CEILING BOX.

Big British Electric Tramway Project.

The comprehensive electrical tramway scheme for South Lancashire has been deposited in Parliament, and has passed the Examiner on Standing Orders. It affects 18 different authorities, and the route covered will exceed 70 miles. The capital will be £1,100,000 in £10 shares. The system comprises a perfect network of lines between St. Helens and Manchester, and must be completed within four years of the passing of the act. The route will be lighted by electricity, and waiting rooms will be provided.

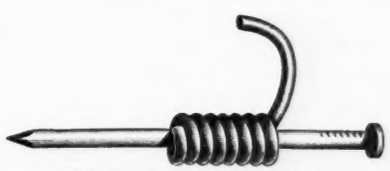


FIG. 3.—A NEW PIPE HOOK.

The plant and lines of the Charlestown, W. Va., Electric Light, Heat and Power Company, were recently sold at public auction to the trustees of the estate of C. E. Ebrehart, of Hanover, Pa. The sale was made to pay mortgages and to settle the Ebrehart estate. The price paid was $10,150.

A Unique Transformer.

A transformer of a novel type has been erected for the Acheson Graphite Company on the property of the Niagara Falls Power Company adjoining the works of the Carborundum Company. This transformer, rated at 450 kilowatts, delivers a larger quantity of electrical current than any other machine ever constructed. The current is utilized in a new industry, founded by Mr. E. G. Acheson, president of the company, for making graphite from amorphous carbon or coke. At present only the one transformer has been installed, owing to the experimental nature of the industry. Current is received from the Niagara Power Company at a voltage of 2,200, for which the primary of the transformer is wound, and it delivers 37,500 amperes at 12 volts, and has ample capacity safely to supply the same number of amperes at 14 volts. It is also designed to deliver its full rated-power at 30 volts, or at any one of a number of intermediate voltages down to 12, the delivered current being inversely proportional to the secondary voltage.

This unique transformer, manufactured by the Westinghouse Electric and Manufacturing Company, is oil-insulated and water-cooled and cased in a circular tank about six feet high and 64 inches in diameter. The secondary circuit consists of a single turn of massive copper bars, which run out through the top of the transformer to heavy leads to the switchboard, and then pass through the wall of the building to the furnace on the other side. The leads consist of 16 copper bars, eight in parallel, the bars of the two polarities being interlaced to reduce the inductive effect. The cross section of each bar is six inches by seven-eighths of an inch. The power factor, as measured on the primary, has been raised to about 85 per cent by means of the system of interlacing. This high standard reflects great credit upon the designer and builders of the transformer, since the circuit carrying this large current at so low a voltage, embraces a considerable area for inductive action at the surface, in spite of every care which may be taken in interlacing the leads.

The methods of varying the secondary pressure from 30 to intermediate voltages down to 12, or *vice versa*, are very interesting. All alterations of potential are carried on in the primary, or 2,200-volt side, since the secondary circuit is not designed for changes of connections. The delivered voltage is varied by changing the number of primary turns in circuit across the 2,200-volt line, this variation changing the electro-motive force per turn within the transformer by changing the density of the alternating magnetic field set up in the iron core. The voltage set up in the one secondary turn is varied proportionally by this change of density in the iron core. The variation of the number of primary turns is made without any interruption of the circuit by means of switches and of a very simple arrangement of preventive resistances, which the constant load makes available.

Upon the switchboard are mounted 20 switches, corresponding with the number of steps from maximum to minimum turns in the primary, 11 of these being running steps on which the transformer may be worked for any length of time, and the other nine being merely intermediate, change-over steps connected through resistances which are not designed to carry the load permanently. Should any one of the running switches be closed, the incoming line is connected directly into the transformer winding at a point dependent upon the switch closed. Between the points at which these switches are tapped into the winding there are other taps running to change-over switches, which are connected with the incoming line only through a resistance. This resistance is sufficient with the normal primary current of 240 amperes, which does not vary, to cause a drop equal to about half the drop between any two consecutive running switches. For example, if switch No. 1 be closed, the transformer would be delivering the lowest voltage to the secondary, then the first change to raise the voltage would be to close switch No. 2. This would connect the preventive resistance in parallel with the few turns of the primary between switches 1 and 2. If switch 1 be now opened, the whole primary current of 240 amperes would flow through the resistance, and in through switch No. 2, causing a slight increase of the secondary voltage due to the reduced number of primary turns, and in spite of the resistance in the primary. If switch No. 3 be now closed, it would throw the resistance in parallel with the section of the primary between switches 2 and 3. Switch No. 2 would then be opened, leaving the circuit closed to the running point 3. By using the intermediate switches connected with the resistance, similar results would follow in changing over to other running switches, so that no interruption of the circuit would occur, nor a short-circuiting of any part of the transformer winding. The switches, insulated from each other by slabs of marble, are not fitted with handles, but are designed with holes in which a hook on the end of a wooden pole may be inserted. The resistances are of an ironclad type similar to street railway diverters.

Owing to the low resistance of the raw material used for conversion into graphite, and also of the finished product, the voltage used is very low. The transformer operates at approximately constant loss and constant efficiency, whatever voltage be employed. As the number of turns is reduced the copper loss in both the primary and secondary is also reduced, but the iron loss is proportionately increased, and *vice versa*, thus the total loss is about constant. Since the total power remains constant, the efficiency of the transformer varies very slightly throughout the range of its work.

Electric Power in Packing Houses.

The success of the electric power plant, with which the South St. Joseph, Mo., plant of Messrs. Swift & Company is equipped, has led that concern to substitute electric for steam power in all its plants. The main house, at Chicago, is already being equipped with generators to supply the 3,200 horse-power required to operate that plant. The substitution of electricity for steam in Swift's Chicago plant will, it is estimated, result in an annual saving of $50,000.

Mr. Swift, the Ladies and the Street Cars.

[*From the American Machinist.*]

Our esteemed correspondent, Mr. Tecumseh Swift, writes to the New York *Times* that if ladies had their right arms cut off they would invariably face forward when alighting from a street car, because they would then have to use the left hand to guide and steady themselves. The reasoning by which this chunk of wisdom was evolved leads him to propose the running of street cars upon the left-hand tracks and with single track lines to allow passengers to get off only on the left side. This might be worth trying.

The Dangers of Gas.

The clerks employed in the office of the Union Pacific and Central Pacific Railroads, 287 Broadway, New York city, were startled yesterday afternoon by three successive explosions of gas in the cellar, says the New York *Sun*. The gas had probably accumulated in the subways in the street and had leaked into the basement, which is seldom used. The clerks ran into the street believing that the building was about to fall. They found a crowd in the street gathered about a small boy and laughing at him as he grabbed frantically at the seat of his trousers, where the cloth was smoking. The people in the street said that the small boy had been over an iron manhole cover when the first explosion occurred and had been thrown about three feet in the air. He was not harmed by his experience except that his trousers caught fire. When he had extinguished the fire, the boy started for home.

ELECTRIC RAILWAYS

The Union Traction Company, of Indianapolis, has let out its contracts for building the sub-power houses at Marion, Dalesville, Fairmount, Elwood, Alexandria, Ingalls and Lawrence.

Another link has been added to the trolley system controlled by the Whitney-Smith syndicate, in the through line across New Jersey. The Elizabeth & Westfield Company has purchased the Union & Middlesex Company's seven-mile line to Boynton Beach.

The United Power and Transportation Company, the organization that owns and controls the trolley roads of Delaware County, of Norristown, Reading, Trenton and a number of other places, has purchased a large tract of land in Chester, and will erect a great car repair shop and shed.

The stockholders of the Beaver Falls, Pa., Traction Company, have elected the following directors: John M. Buchanan, Robert S. Kennedy, A. M. Jolly, H. S. McConnell, W. C. Simpson, T. P. Simpson and H. P. Brown. The only change in the board was the substitution of Dr. H. S. McConnell for James P. Stone.

C. S. Drummond, one of the directors of the British Electric Traction Company, which owns 50 electric railways in various portions of the world, proposes to construct an electric railway throughout Rossland, B. C., and to the mines on Sophie Mountain, a distance of 15 miles. The project is favorably regarded by the city authorities.

The stockholders of the United Traction Company, of Albany, N. Y., have voted unanimously to increase the capital stock from $4,000,000, consisting of 40,000 shares at the par value of $100 each, to $5,000,000 consisting of 50,000 shares of the par value of $100 each. The stockholders and proxies voted on at the meeting represented $3,000,000 worth of stock.

An electric railway between Salt Lake and Ogden is planned. The notable features are outlined to be 70-pound rails, overhead trolley system, double track between Salt Lake and Farmington, half-hour service to that town, and hour service to Ogden. Those who are at the head of the project state that work will commence at once and should be finished this year, adding that if the equipment can be secured a large portion of the line can be in operation by August 1.

The much talked of trolley line across northern New Jersey is now a certainty. Work is about to be begun at Phillipsburg, and pushed eastward to meet the New Jersey Traction Company's line, from Jersey City, at Caldwell, near Lake Hopatcong. The Philadelphia capitalists say the line will be completed within four months. With the connection at Caldwell it will be possible to ride by trolley from Jersey City to Siegfried's, Pa., a distance of more than 100 miles, and far less than one-half the present railroad fare.

The stockholders of the United Railways Company, of Baltimore, Md., have met and reelected the old board of directors, and also President Perin and the present officers. The report of the president, covering the nine months of the existence of the company, showed a surplus of $42,000, after paying interest on the consolidated mortgage bonds and other fixed charges. Stockholders of the United Electric Light and Power Company, which is controlled by the United Railways company also met, but made no change in the directory or officers. The financial statement showed net earnings of $50,122.

It is announced upon reliable authority that the Southwestern Traction Company, of Philadelphia, has been absorbed by the United Power and Transportation Company. The latter corporation controls the lines of the Chester Traction Company, the Delaware County, from Media to Philadelphia, and roads in Wilmington, Reading, Trenton and other places in this section of the country. By this arrangement the purchasing company will control the Delaware River front line, which was to have been the Philadelphia connection of the Philadelphia & Delaware Railroad.

The recent condemnation of the Reading turnpike company's road between Pottstown and Trappe, awarding the company $24,000 damages, will eventually result, it is believed, in a trolley line from Philadelphia to Reading without change of cars. The transfer recently of the trolley line between Philadelphia and Norristown and Trappe to the same company which controls the Reading street railways, is looked upon as significant, and is believed to mean the extension of the lines from both places. The Pottstown Passenger Railway Company, whose lines extend from Stowe to Sanatoga—a distance of about three miles—will probably also be purchased by the Union Traction Company.

Trolley line development is taking on energy in the eastern section of Connecticut, and the season will probably see a connecting line from Danielsonville to Providence, R. I., and another from Willimantic south, which will make connection at Baltic with a line from Norwich. The later line practically parallels the Central Vermont in its through connection and the Providence division of the Consolidated until it reaches Baltic. The figures show that last year the trolley lines in the state carried over 59,000,000 passengers, while the steam roads only carried 53,000,000 in round numbers. The interesting fact is, however, that the receipts from fares on the steam roads were larger by some $450,000 than before the trolley was introduced, although there was a decrease of nearly 3,000,000 passengers. This makes it evident that the trolleys are doing the short haul business, and contributing to the long haul of the steam roads by the increased facilities of getting about.

The Lighting of Indian Cities.

In reply to an inquiry, U. S. Consul Fee, of Bombay, on December 7, 1899, says:

The use of electricity as power and light is yet in the earliest stages in India, Madras being the only city using it as a motive power for street cars. Bombay is poorly lighted by gas, and her tramway is run by horse-power. This company has its main office in New York city, and the stock is owned principally in the United States. It has applied to the Bombay municipality for the privilege of converting its motive power to electricity. This will undoubtedly occasion other electric improvements. Electric lights are used in a limited way in the better class of residences and bungalows. Bombay is the best place in which to locate an agency. It is not only great in population (having over 821,000), but also in wealth and trade. One-third of all the exports from the United States to India come to this port. The systems of Indian railways as well as the steamship lines centre here. The bulk of electric supplies now come from Europe. The United States during the past few years has been pushing her trade in this line and the late steamers have had noticeable shipments of these supplies from New York.

The directors of the People's Electric Light Company, of Oswego, N. Y., have elected Mr. Howard C. Lewis to the directorate and presidency, to succeed the late S. Dana Greene. Mr. Lewis is connected with the law department of the General Electric Company.

TELEPHONE AND TELEGRAPH

The capital stock of the Michigan Telephone Company will be increased from $2,500,000 to $10,000,000, according to President Glidden, of the Erie system.

The Oshkosh, Wis., Northwestern Telephone Company, a local independent concern, has passed into the possession of the Erie Telephone Company, and that company is now undisputed master of this field. The purchase price is in the neighborhood of $50,000.

A certificate of an increase of capital stock of the Bell Telephone Company, of Buffalo, N. Y., from $2,000,000 to $5,000,000 has been filed with the Secretary of State. The debts of the company, it asserts, are not to exceed $500,000. The certificate is signed for the stockholders by Sherman S. Rogers and William H. Watson.

Referring to the recent increase of $5,000,000 in the capital stock, the Erie Telephone and Telegraph Company announces that the underwriters have taken up 30,000 shares of the treasury stock at par, paying therefor $3,000,000, which, with the 20,000 shares already subscribed at par by the stockholders and payable February 14, will give the Erie Company $5,000,000 in cash with which to carry on necessary extensions during the year and entirely extinguish the floating debt of the company. The total issued capital of the Erie Company on February 14 will be $10,000,000, fully paid. During the past year the company disbursed about $4,500,000 for extensions, made a net gain of 43,700 subscribers, and now has a total of $111,000.

At the annual meeting of the Central New York Telephone and Telegraph Company in Utica, the president's report showed the following: The gross revenue for the year was $251,060.93; the gross expenses were $209,589.23; net revenue, $41,471.70. Compared with the year 1898 this shows there was an increase of gross revenue of $16,974.40; an increase of gross expenses of $19,900.50; a decrease of net revenue of $2,926.10. The revenue from the toll lines shows an increase over 1898 of $5,418.37. The total number of exchange subscribers December 31, 1899, was 4,457, a gain of 444 during the year. The usual annual dividend of six per cent on the issued capital stock, was declared and paid quarterly. The following officers were elected: President, Lewis H. Lawrence; first vice-president, Joseph Rudd; second vice-president, Jeffries Wyman; secretary and treasurer, F. G. Wood; general manager, C. A. Nicholson.

The recent decline in Bell Telephone stock to 340, says the Boston *News Bureau,* was attributed to the issue of $20,000,000 bonds by the Western Union Telegraph Company, and fears that the issue was for the purpose of crossing swords with the American Bell Telephone Company. The delay in announcing plans for the removal of the American Bell Telephone Company from the state of Massachusetts through exchange of its stock for Long Distance Company stock, is believed to be due to the reluctance on the part of the Bell Telephone people to remove from the state. Bell people have hopes that before the present legislature adjourns it will be possible for the state to show its willingness to allow the American Bell Telephone Company to remain in the state and carry out the demands of its business. The plans of the Bell Telephone Company for removal from the state have not progressed to an extent to prevent the directors from changing their plans.

TEXAS SIFTINGS.

There has been a great deal of activity in electrical matters in Texas since my last letter, especially in the larger towns.

In Waco an independent telephone company started up under the most favorable conditions last month; the equipment and the details of the installation are of the strictly up-to-date modern types. The Stromberg-Carlson central energy system is used. Underground cables cover the fire limits of the city and copper wire is used throughout. The exchange started off with 600 subscribers, and is adding more to the list daily. The company is composed of local people and has now invested about $100,000 in exchange and toll-line property and it is intended to extend its toll-line property indefinitely. Houston also has an independent telephone plant which has been installed during the past nine months. This installation was made from plans and specifications drawn by Mr. Paul W. Bossart and constructed under his personal superintendence. It is in every respect thoroughly first-class. The system used is magneto call-bell and transfer. All lines are full metallic and I am informed that nearly 100,000 feet of aerial cable has been used. This company, unlike the Waco Company, is backed by foreign capital. Parties from Ohio own practically all of the stock. The plant so far has cost over $100,000, and will cost possibly $25,000 more before it is finished. The subscribers list has passed the 1,000 mark and will probably reach 2,000 within the two years, the present switchboard capacity being 1,200 with 600 connected.

Houston also will have a brand new electric lighting and power plant in operation by March 1. This installation is being made by the General Electric Company, under the superintendence of Mr. W. G. Reed for the General Electric Company, and Major Chapman for the local company. This plant will embrace all of the latest types of steam and dynamo machinery, including alternating arc lights. The company has spared no expense and will start up with a model plant.

The Southwestern Telephone and Telegraph Company has kept a large force of men employed throughout the Summer and Autumn months, rebuilding its Houston exchange and providing extensions to meet the increased demand for service which has been created by the appearance in the field of an opposition company. There is no indication of a rate war at present, and none is expected. Among other improvements worthy of mention the long-distance lines relay station recently constructed by this company at the eastern limits of the city deserves especial mention. The character of the construction, which is of massive proportions, is simply superb, if such a word is permissible in connection with artistic telephone construction. The plans and work were made and done under the superintendence of Mr. Dell McReynolds. The installation of apparatus was made under the direction of General Superintendent Jeavons, who is also entitled to the credit of being the originator of a new system of duplex telephone and telegraph which is used by this company very successfully.

This company has recently acquired by purchase three independent companies, *viz.*, Hallettsville, Tex., Calvert, Tex., and Gonzales, Tex., all small outfits. The only significance which can properly be attached to these purchases is that they strengthen its toll-line position; it is also paying some attention to the building of exchanges in the smaller towns, presumably for the same purpose.

San Antonio will soon have an independent telephone company. The City Council recently granted a franchise which I understand has been taken up by some Ohio capitalists headed by Mr. C. H. Haskell, president of the Detroit, Lima & Northern Railway, and who, with a party of friends, recently toured over this part of the state in his private car.

M. O'REANON.

Galveston, Tex., February 9.

INDUSTRIAL NOTES

D. L. Bates & Company, Dayton, Ohio, have ready a catalogue of their season's ceiling and desk fans.

The Michigan Electric Company, Detroit, is agent for the line of fan motors made by the Western Electric Company.

The Bullock Electric Manufacturing Company, Cincinnati, recently shipped an 800-kilowatt generator to the Oakland Transit Company, Oakland, Cal.

The Electric Appliance Company, Chicago, announce that they are now putting up their "Eaco" tape in tin boxes of one-half pound each.

The New York Belting and Packing Company, has ordered a 75-kilowatt direct-connected generator for its new factory in Passaic, N. J., from the Sprague Electric Company, New York city.

The Garl Electric Company, Akron, Ohio, are the manufacturers of a comparatively new system of telephones for intercommunicating service which is said to have many features of merit.

The new "Peerless" ceiling fan in several styles, with or without electrolier attachment, is illustrated in a circular recently issued by the Warren Electric and Specialty Company, Warren, Ohio.

The American District Steam Company, Lockport, N. Y., is preparing for a most active season. This company controls the patents for the Holly system of steam heating through underground mains, either for direct or exhaust steam.

The Electric Appliance Company, Chicago, are very much pleased with their new agency for the Adams-Bagnall enclosed arc lamp. They state that their business in that line is growing in a remarkable degree.

"Is your light and power plant losing money," is the question the Hays Construction Company, Troy, Ohio, are asking. This engineering company remodels systems and engineers light and power plants to an economical and profitable basis.

The North Electric Company, Cleveland, Ohio, telephone and switchboard manufacturers, has recently completed a central battery intercommunicating system. The instruments are excellently finished and are of a most serviceable character.

The E. S. Ward & Company has equipped its new factory in Waverly, N. J., with Lundell apparatus, having ordered from the Sprague Electric Company, New York city, one 25-kilowatt and one 75-kilowatt generator, belted type, of 250 volts, and 15 motors ranging from two to 20 horsepower.

William Roche, inventor and manufacturer of the new Standard dry battery, 42 Vesey street, New York, reports great activity in the demand for dry cells. His production, he says, average two to three thousand daily and orders are in hand sufficient to keep his present force of men busy for three to five weeks.

The Belden-Larwill Electric and Manufacturing Company, Ft. Wayne, Ind., is energetically pushing the "Belden" system of arc lamps for all circuits. It has recently received from the press an artistically illustrated catalogue showing the construction, operation and general appearance of the different types of Belden arc lamps.

Fred M. Locke, Victor, N. Y., advises us that he will send a copy of his latest catalogue, illustrating and describing the "Locke" patent high-potential insulators, triple petticoat insulators in china and glass, steel pins with china bases, iron fittings and line materials, etc., to those who write for it. These are all manufactured in the new factory at Victor, N. Y.

The Sprague Electric Company, of New York city, has equipped one of the Old Dominion Line steamers with a quantity of Lundell fans, finished in white and gold to correspond with the cabin decorations. They make an attractive as well as a useful addition. The fans are mounted to run in an inverted position, the motors being attached to the ceiling.

The Hudson Rule Works, of Matteawan, N. Y., are manufacturing a very attractive advertising novelty in the shape of a vest-pocket steel rule. The rule is in three sections, one folding over the other, and is inserted in a leather case provided for it. The back of the rule can be used for a firm's advertisement or its name and address. It is a very convenient pocket souvenier.

The Cutler Hammer Manufacturing Company, Milwaukee, Wis., write as follows: "Our business is steadily increasing and our output each month is larger than the preceding month. The orders received during January were larger than we have ever received before during any one month, one order alone being for 2,500 horse-power in rheostats, which we believe is the largest order of this kind which has ever been placed."

The New York Central & Hudson River Railroad has "dropped into poetry." Mr. W. J. Lampton, the talented chief poet of the New York *Sun,* is responsible for an ode in six stanzas, of which three are quoted below:

Where the mild Mohawk meanders,
Where the lakes and pleasant streams,
Among the vales and mountains,
Lie still in silver dreams;

Where hamlet, town and city
Thrive as the green bay tree,
Beneath the fost'ring care of
The only N. Y. C.

There every man is happy,
There every woman, blest—
They simply press the button,
The Central does the rest.

The Ward Leonard Electric Company, Bronxville, N. Y., is distributing its new 1900 catalogue, which is most comprehensive, embracing nearly every type of rheostat that the electrical trade demands for both starting and controlling service, with cuts fully describing the various types and sizes of each instrument. This catalogue covers nearly 1,000 standard stock rheostats and circuit breakers. The Ward Leonard Electric Company has sold, during the past three years, over 100,000 rheostats and circuit breakers. Some weeks ago the company distributed a considerable quantity of advance sheets from this catalogue, with the result that its business has so much increased that it is obliged to greatly increase its capacity to accommodate the great increase of business resulting therefrom. With the introduction of this catalogue the prices on the well-known type of Carpenter enamel field rheostats have been reduced from 25 per cent to 150 per cent (depending upon the size and type) over prices prevailing for equivalent apparatus six months ago, while on most sizes the number of steps has been increased for the same size of instrument.

The American School of Correspondence, situated at the famous seat of learning, Boston, makes a specialty of steam, electrical and mechanical engineering. A careful inspection of the school's attractive instruction papers convinces one of the painstaking thoroughness and accuracy which distinguishes the work of this New England institution. The school is chartered by the Commonwealth of Massachusetts, and enjoys the respect and confidence of thousands of earnest students throughout the United States. The instructors are all graduates of leading scientific schools, and have had valuable experience along engineering lines. The benefit to the student of this expert supervision can not be over-estimated. The courses have been carefully laid out by prominent educators and engineering experts. They embrace every subject required by the up-to-date engineer and mechanic in order to have complete mastery over the theoretical details of his daily work. The school was founded to give high-grade instruction to those men who have been compelled by adverse circumstances to leave school at an early age, in order to earn a living. With this idea in view, the tuition has been purposely placed very low so that no wage-earner shall be debarred from receiving the benefit of such a course. By taking advantage of the school's generous offer, the ambitious mechanic can receive a thorough technical education in his profession by merely devoting his spare moments to systematic home study. Almost every man has, at some time, felt the need of a better knowledge of the theoretical details connected with his work, and this school has been founded to supply this much needed education. A postal card addressed to the American School of Correspondence, Boston, Mass., will procure a handbook, describing its methods, and letters from graduates giving results of their experience.

ADVANCE INFORMATION

Electric Light and Power.

MT. PLEASANT, TENN.—A charter has been granted to the Mt. Pleasant Electric Company, with $15,000 capital stock. The incorporators are: E. L. Gregory, C. H. Ingram, J. G. Ingram, H. D. Ruhm and John Ruhm, Jr.

ST. PAUL, MINN.—Manhattan Light, Heat and Power Company. Manufacture and sale of electricity and steam. Capital, $1,000,000; incorporators: L. L. C. Brooks, A. W. Zahn, F. C. Nelson, all of St. Paul.

NEWPORT NEWS, VA.—The Consumers' Light, Heat and Ice Company has been chartered, the capital stock being $100,000. This organization will run in opposition to the Peninsular Electric Light and Power Company, the principal stockholders in which are Alexander Brown & Sons, of Baltimore.

CLINTON, ILL.—Clinton Gas Company. Operating gas and electric plants. Capital $50,000; incorporators: H. L. Olds, E. F. Irwin, both of Clinton; W. H. Odiorne, of Springfield.

ALBANY, N. Y.—Senator Ellsworth has introduced a bill incorporating the Lockport & Newfane Power and Water Supply Company, with a capital of $500,000. The business of the company shall be the development and employment of hydraulic and electrical power, and supplying it to the citizens of Niagara County. Willard T. Ransom, Henry I. Pierce, John A. Merritt and Harry L. Ransom are named as incorporators.

LOS ANGELES, CAL.—San Pedro Terminal Gas, Electric and Power Company. Deal in electricity, gas, etc. Capital, $100,000; incorporators: F. H. Rindge, of Santa Monica; H. V. Carter, G. I. Cochran, W. Gilleden, L. A. Phillips, all of Los Angeles; W. J. Williams, W. W. Beckett, J. R. Haynes, all of Pasadena.

BRIDGEPORT, PA.—Bridgeport Electric Light, Heat and Power Company. Supply light, heat and power. Capital, $12,500; incorporators: J. S. Elliott, of Jefferson Township; W. H. Fisher, E. T. Bradshear, both of Brownsville; G. D. Howell, W. J. Sturgis, both of Uniontown.

CAMDEN, N. J.—Consolidated Electric Company. Deal in gas and electricity. Capital, $100,000; incorporators: S. R. Ketcham, C. H. Lamb, G. H. B. Martin, all of Camden,

TRENTON, N. J.—The South Jersey Water and Electric Power Company, of Vineland, has been incorporated to construct dams. Capital, $250,000; incorporators: C. K. Landis, Matilda T. Landis, M. Fry, all of Vineland.

EVANSTON, ILL.—The Evanston Yaryan Company, of Evanston, has been chartered to furnish electricity. Capital, $2,500; incorporators: W. O. Merrick, C. Woodward, N. J. Kasper, all of Evanston.

HEMPSTEAD, N. Y.—The Roslyn Light and Power Company has been incorporated to manufacture electricity for light, heat and power purposes in the towns of North Hempstead, Oyster Bay and Hempstead, Nassau County. Capital, $50,000; directors: R. D. Winthrop, of Westbury; C. H. Mackay, of Roslyn, and E. D. Morgan, of Newport, R. I.

DAYTON, OHIO—The Citizens' Electric Light, Power and Heating Company, of Dayton, has been incorporated. Capital, $200,000; incorporators: W. T. Block, G. G. Luthy, W. Craighead, J. W. Kreitzer, S. D. Bear.

YOUNGSTOWN, OHIO—The Merchants' Light, Heat and Power Company, of Youngstown, has been formed for furnishing arc and incandescent lights, etc. Capital, $50,000; incorporators: H. F. Kaercher, D. F. Anderson, G. E. McNab, W. R. Beard, P. C. Kaercher.

Electric Railways.

FORT WAYNE, IND.—The commissioners of Huntington County, Ohio, have granted a franchise through that county to the Ohio & Indiana Traction Company, organized to build an electric road from Hicksville, Ohio, to Marion, *via* Fort Wayne and Huntington. The line runs west through Huntington County to Huntington, and then extends southwest through Mt. Etna to Marion. Work on the grade will begin this Spring, and the road will be in operation early in 1901.

BELVIDERE, PA.—The Warren County Traction Company has filed papers of incorporation. The company is formed to construct and operate a trolley line from Phillipsburg to Washington, and from thence to Belvidere. The capital is $250,000, and the incorporators are: Howard Mutchler, Easton; Morris M. Reading, Phillipsburg; Robert A. Montgomery, Lambertville; Charles L. Hemingway, Easton; Richard B. Reading, Lambertville; William S. Pursell, Phillipsburg, and Frederick Frelinghuysen Kennedy, Bloomsbury.

Miscellaneous.

COLUMBUS, OHIO—The Morgan Engineering Company has filed articles of incorporation with the Secretary of State. The capital stock is $3,000,000, half of which is to be preferred. The company is to manufacture and deal in hydraulic, electric, pneumatic, gas and fire machinery, including guns and ordnance. The headquarters is to be at Alliance, Ohio.

CAMDEN, N. J.—The Sun Electric Manufacturing Company, of Camden, has been incorporated to do general telephone and telegraph business. Capital, $2,000; incorporators: E. Williamson, of Media; E. Hall, G. A. Dougherty, J. R. Cantlin, all of Philadelphia, Pa.; S. Dole, of Camden.

EXPORT NOTES

A company has been formed in Brussels, Belgium, to be known as "La Societe des Zincs et Plombs du Cautal," to acquire and develop certain deposits of lead and zinc ore at Cautal, France. The capital of the company is stated to be $240,000. More than a third of the capital is to be invested in modern equipment for the undertaking of the work early in April.

"La Sociedad Electrica de Besaya" is the title of a new company just formed in Santander, Spain, with a capital of $400,000. The company is to erect a large power plant to supply electrical energy for lighting and power purposes in that city. The power plant is to be located 55 kilometres from Santander, at a point where the power of the River Besaya is to be utilized. No contracts have as yet been placed.

A cable from Vienna to the Chicago *Record* states that the president of the Hungarian State Railways has petitioned the Ministry of Commerce for permission to make a trial of accumulator cars between Vienna and Budapest in order to ascertain whether or not the entire traffic of the Hungarian State Railways may be carried on by this means. The Ministry has given its consent to the experiment, and it is hoped by engineers, both in Hungary and Austria, that before long electric locomotives may be in use on all the railways belonging to the state.

Concerning a scheme for extending the electric lighting system of the city of Dublin, Ireland, Consul Joshua Wilbour reports that the approval of the Municipal Council has been secured. If the local government board approves of the scheme, as it undoubtedly will, the Consul says it will empower the corporation of the City of Dublin to apply for a loan of $1,272,000 to carry out the extension. As soon as the loan is raised the specifications will be prepared and the various contracts advertised. It is thought that the corporation will be in a position to receive tenders by March 1 next. The expenditure will include, among the important details, $100,000 for the buildings, foundations for plant, chimney, etc. The engine house plant is to cost $179,500; boiler house plant, $58,350; pipe and feed tank, $17,500, and 500 lamp posts, etc., $55,000. The Consul adds that there is no reason why a large proportion of the work should not be secured by American manufacturers, as in Dublin there is already a large power station for the tram company in which American machinery is installed and giving satisfaction.

ELECTRICAL PATENTS

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED FEBRUARY 13, 1900.

643,133 Safety device for electric-distribution systems; E. M. Hewlett, Schenectady, N. Y.—A generator, a circuit-breaker, the controlling connection of said generator with the system, and means actuated by the circuit-breaker for cutting off a desired part of the station load when the circuit-breaker opens.

643,148 Electric signal and automatic alarm for railway trains.

643,162 Alternating-current meter; G. A. Scheefer, Peoria, Ill.—A rotating disk, a magnetic core placed perpendicularly thereto, a shunt-winding, a series coil, and an additional magnetic body affording a derived circuit to direct lines of force from the disk.

643,179 Thermostatic apparatus; E. F. Woodman, Boston, Mass.—Comprises circuit-changing means adapted to be included in an electric circuit, and a cellular controller for said means, said controller being composed of homogeneous fusible material and subjected to tensile strain.

643,205 Switch; A. W. Rumsey, Detroit, Mich.

643,225 Telephonic repeater; J. Houelhan, Toledo, Ohio—Consists of a vibratory needle or armature, having diaphragms on opposite ends thereof, electromagnets opposite said diaphragms, said electromagnets also bearing diaphragms, mechanical connections between said diaphragms.

643,228 Means for controlling and indicating the supply of electric energy; C. R. Loubery, Paris, France—A local circuit, a coil included in said circuit, means adapted to be actuated by said coil to control or indicate the consumption of electrical energy by the local consumer, an auxiliary or controlling circuit, and means adapted to be actuated thereby to vary the resistance to the passage of the current through the local circuit.

643,254 Electric furnace; A. J. Peterson, Notre Dame, France.

643,255 Electrically-operated day and night signal for railways; J. J. Saville, Omaha, Neb.

643,276 Electric traction-motor; C. Richter, Camden, N. J.—A hollow car-wheel having a web provided with a manhole, an axle carrying a field-magnet with an opening in the core thereof, and a brush seated in said opening, said manhole being opposite to said opening.

643,283 System of distribution for electric railways; W. Chapman, Washington, D. C.

643,309 Device for disinfecting telephones; W. H. Taylor, Stamford, Ct.—A mouthpiece, a removable cap applied to the end thereof, a disinfectant secured in said cap and means for expressing the disinfectant from the cap in the act of removing the cap.

643,327 Mine-trolley hanger; G. E. Jamme, Jr., Pittsburgh, Pa.

643,579 Printing telegraph; L. Kamm, London, England.

643,392 Electric meter; J. H. Barker, Cambridge, England—A revolving conductor, a pivoted or suspended magnetic brake and means to prevent excessive angular movement of the brake.

643,401 Electric falshing switch; A. L. Cotter, Cleveland, Ohio.

643,413 Electromagnetic variable-speed and clutch gearing; R. Kennedy, Leeds, England.

643,414 Surface-contact stud for electric traction; W. Kingsland, London, England.

643,442 Controller; T. von Zweibergk, Cleveland, Ohio.

643,484 Microphone transmitter; G. F. Dupont, Paris, France.

643,506 Electric clock; Henry Iverson, Corsicana, Tex.

643,545 Telephone-telegraph; A. Sinding-Larsen, Frederiksvaern, Norway.

643,609 Signaling system; J. J. Ruddick, Newton, Mass.

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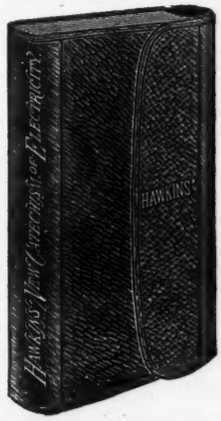

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